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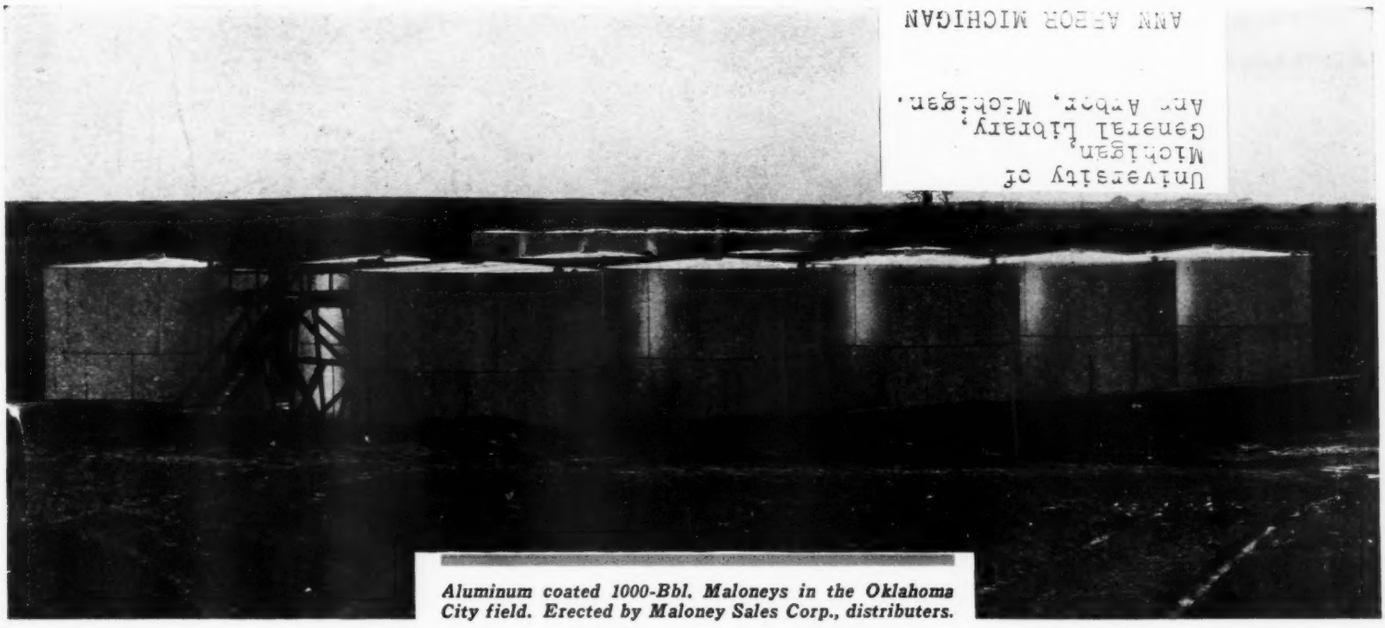

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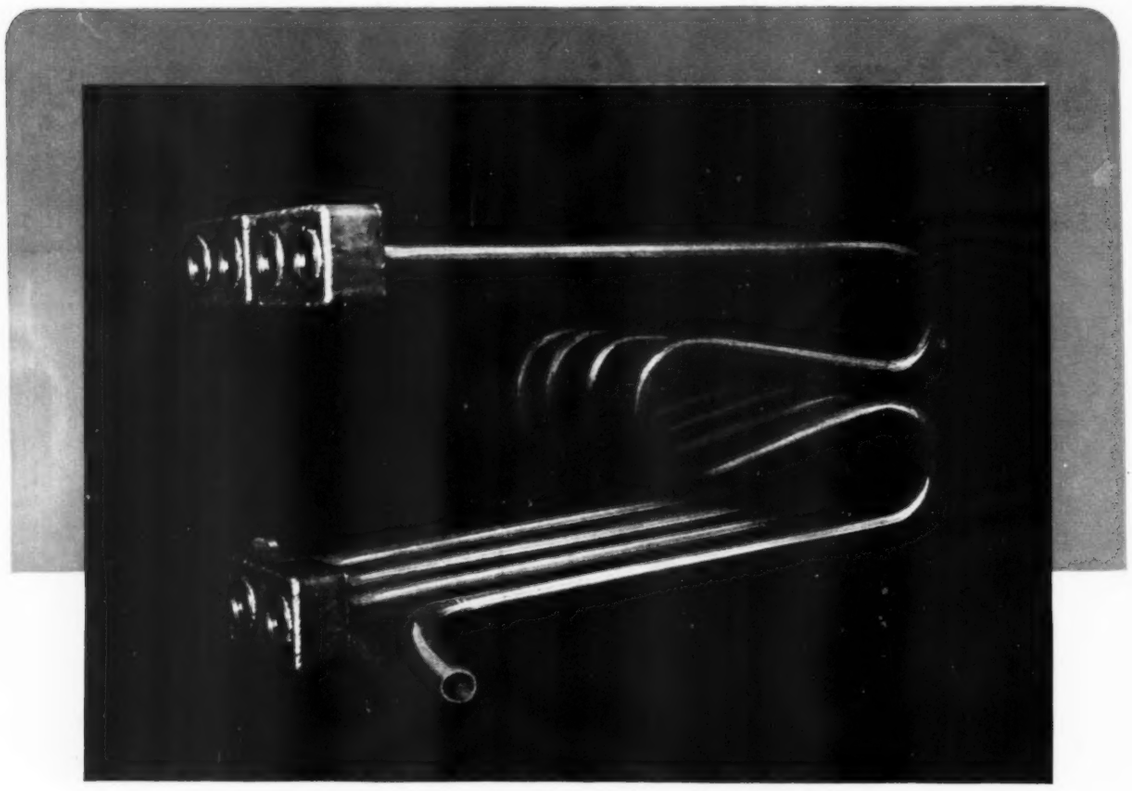

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BRANCH OFFICE CORRESPONDENTS

D. H. Bancroft, 538 Ricou Brewster Building, Shreveport, La.
L. E. Bredberg, 610 Petroleum Building, Fort Worth, Texas.
Paul A. Elliott, Chronicle Office, Muskegon, Mich.
Tolbert R. Ingram, 130 State Office Building, Denver, Colo.
Charles E. Kern, 602 Albee Building, Washington, D. C.
Victor Lauriston, Box 136, Chatham, Ontario, Canada.
B. E. V. Luty, Bessemer Building, Pittsburgh, Pa.
A. E. Mockler, Rooms 1919-21, No. 154 Nassau Street, New York, N. Y.
B. D. Stevenson, 1504 Milam Building, San Antonio, Texas.
L. P. Stockman, 522 Union Oil Building, Los Angeles, Calif.
F. B. Taylor, Box 994, Casper, Wyo.
John B. Waldo, Room 1416, No. 6 North Michigan Blvd., Chicago, Ill.
Leon H. Walter, Oil City Derrick, Oil City, Pa.
George A. Whitney, Box 98, Main Postoffice, Toledo, Ohio.
Neil Williams, 1316 Second National Bank Building, Houston, Texas.

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Production Lowest in Four Years

Highest daily average estimated total production in 1929, week ended Aug. 24, 2,975,435 bbls. Lowest in 1929, Dec. 27, 2,595.320 bbls.

But Recent Surveys of Industrial Conditions Point to the Fact That It Is Up to Requirements

Highest daily average estimated light oil production in 1929, week ended Sept. 14, 2,534,524 bbls. Lowest in 1929, Apr. 13, 2 142,036 bbls.

By James McIntyre

Not since October in 1926 has crude oil production in the United States reached the low figure it fell to in the past week, when a daily average of 2,315,881 barrels was registered, a decline of 43,323 barrels per day from the figures of the previous week and 293,311 barrels per day below the production of the same week last year. Production last week was at the rate of 845,300,000 barrels per year, which will give the reader an idea of the measure of success of the curtailment plans of American oil operators, backed in some cases by their state governments.

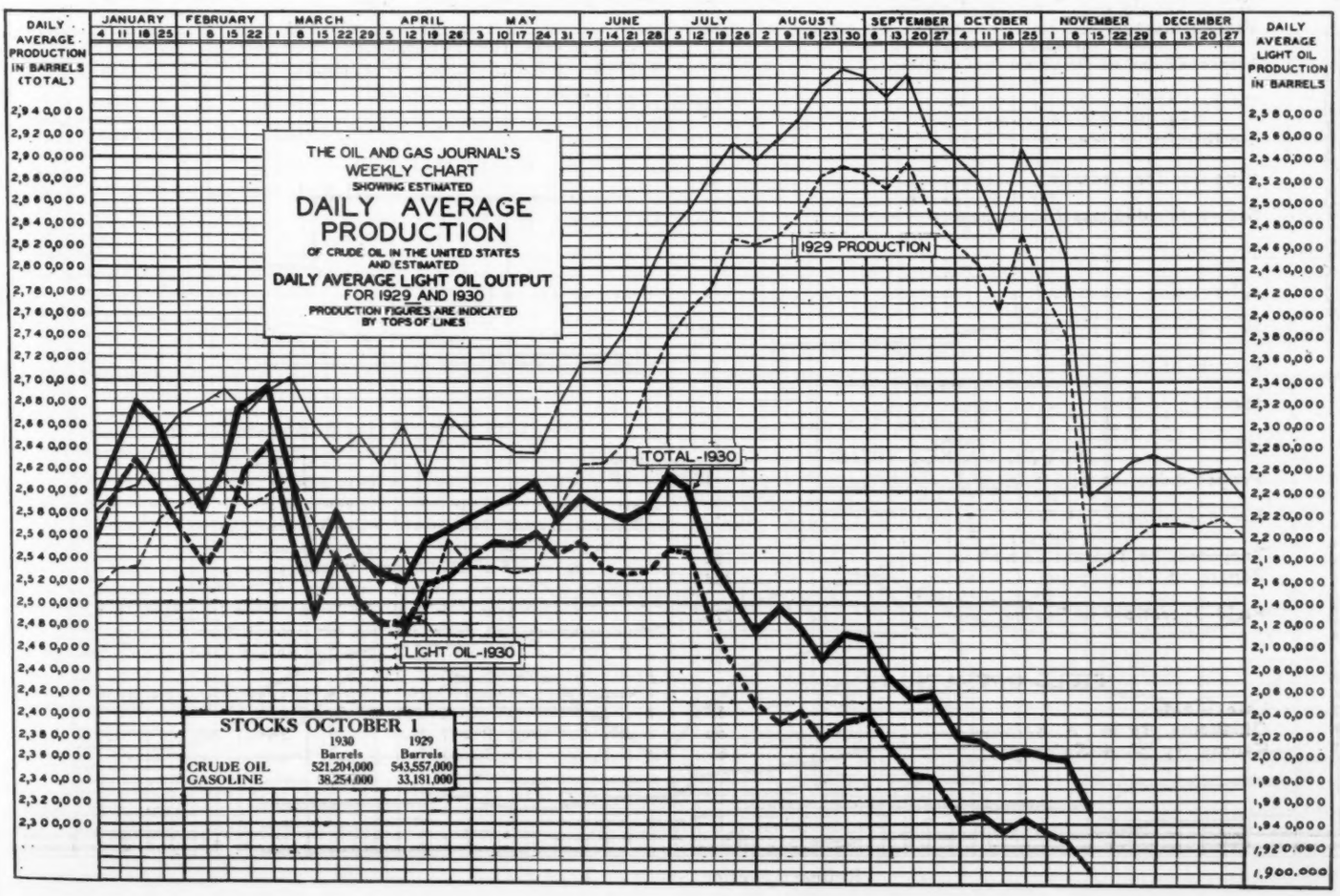
The announcement by one of the great producing companies in Venezuela that it stands ready to cut back its production in that field in line with curtailment in the United States if agreeable to its fellow producers there, lends an additional cheerful note to the production situation, indicating the possibility of a further lowering of the visible supply of crude in these days of a lean market. The preliminary plans for an organization of Kettleman Hills operators for the purpose of carefully and sanely developing that great field is another good sign of the times.

As low as daily production has fallen, it appears not to be too low. It is estimated by the Federal Oil Conservation Board's committee on economics that an average domestic production of not more than 2,290,000 barrels will be required between now and March 31, 1931, but the American Petroleum Institute's fact finding experts put the needed figure at 2,333,000 barrels per day. Last week's production was between these two figures. Whichever committee is closest to the mark, it still behooves the producer to continue his efforts to keep production down to requirements if we are to get out of the woods.

Estimated daily average production of light and heavy gravity oil in the United States for week ended November 8 and a comparison with the previous week follows:

	November 8		November 1	
	Light	Heavy	Light	Heavy
Oklahoma—				
Oklahoma City	66,730	.....	84,785	.....
St. Louis-Pearson	22,760	.....	22,370	.....
Seminole	125,980	.....	137,055	.....
Northern miscellaneous	216,200	.....	220,095	.....
Southern fields	57,380	.....	59,680	.....
Total Oklahoma	489,050	.....	523,985	.....
West Texas—				
Hendricks	58,705	.....	59,215	.....
Yates	109,110	.....	106,845	.....
Remainder	113,078	.....	114,613	.....
Total West Texas	280,893	.....	280,673	.....
North Louisiana	38,520	5,360	37,465	5,440
Arkansas	16,285	35,785	16,700	36,350
North Central Texas	107,800	.....	108,167	.....
Texas Panhandle	84,350	.....	81,365	.....
East Central Texas	42.468	.....	41,808	.....
Kansas	117,260	.....	114,210	.....
Total Mid-Continent area	1,176,626	41,145	1,204,373	41,790
Gulf Coast	.....	180,463	.....	182,902
Southwest Texas	.....	103,236	.....	118,868
Eastern	113,000	.....	113,000	.....
Rocky Mountain area	101,411	.....	103,771	.....
California—				
Santa Fe Springs	98,000	.....	94,000	.....
Long Beach	98,500	.....	98,000	.....
Playa Del Rey	35,000	.....	30,000	.....
Elwood	33,500	.....	38,000	.....
Ventura Avenue	46,000	.....	45,500	.....
Kettleman Hills	24,500	.....	24,000	.....
Remainder of State	178,500	86,000	178,000	87,000
Total California	514,000	86,000	507,500	87,000
Total United States	1,905,037	410,844	1,928,644	430,560
Grand total	2,315,881		2,359,204	

Total Decrease 43,323 Bbls.; Light Oil Decrease 23,607 Bbls.



Early Stabilization in Gasoline Seen

Low and High Prices Quoted by Oklahoma Refiners Moving Closer Together and Belief Grows That Quotations Are on Bottom

By W. T. Ziegenhain

The low and the high of the price range for gasoline as quoted by Oklahoma refiners during the past week moved nearer together and this was taken as an indication that refinery gasoline prices will be stabilized shortly. The confusion caused by the general crude reductions and the daily rumors of abnormally low prices paid for distress material has pretty well passed into the background and it is the general belief that quotations have about reached bottom.

The natural gasoline market is holding firmly at last week's price level and promises to be given support at any time an apparent weakness develops, as stocks have been reduced to a low level. Kerosene is moving slowly despite the expected increased seasonal demand. Fuel oils are being quoted over a wide range of prices, depending upon viscosity and cold test. The heavy, high cold test material is being offered at prices considerably under the quotations on the average grade of fuel oil. Motor lubricants are also moving slowly, but there have been no price reductions since the general reduction October 6. Bright stocks are being freely offered, but the low cold test material commands a substantial premium over the regular grade. Wax commitments have been made, taking the output of several of the larger manufacturers for the next two months, but the prices quoted for immediate shipment from other refineries do not indicate any effort to advance the market.

Association Prices Dropped

During the past week the Export Petroleum Association, Inc., announced that it would discontinue posting export prices. The future plans of the association were not given, nor was there any explanation made as to why this change in program occurred. Several factors, detrimental to the smooth working of the association's efforts and purposes, have been apparent, however, and during the present period of unrest in the refinery market business is said to have gone to outsiders at the expense of association members. In this respect, the association proved to be an unwieldy affair and the temporary suspension of posting prices is generally looked upon as a logical move and a constructive one for the members in the end.

It is difficult to picture the future effect of this on Oklahoma and other Mid-Continent refiners.

At the prices now prevailing on the Gulf Coast it will be difficult for the Oklahoma or North Texas refiner to compete. As an example, 64-66 375 endpoint gasoline is being quoted at the Gulf for 7 cents. With the freight charge at 1.45 cents per gallon and a terminal charge of .25 cent the equivalent price in Oklahoma is 5.3 cents.

This is considered a top price, however, and experience has shown that a considerable volume of gasoline has moved from Group 3 to Gulf points from one-fourth to one-half cent under the posted Gulf price. If this practice of price shading is to continue it will mean that the Group 3 refiner will have to take from 4.8 cents to 5.05 cents per gallon for his premium product, and this is thought to be below cost of production.

The gasoline purchases of the export association from Mid-Continent refiners have been estimated near 175,000,000 gallons during the past year up to October 1. In addition, it is estimated 60,000,000 to 70,000,000 gallons of gasoline has been shipped from the Mid-Continent and Gulf Coast refineries by nonassociation members. The total volume of this business has been an important factor in the Mid-Continent gasoline market at all times. Thus, the dropping of export quotations by the association again places East Coast, Gulf Coast, California and Mid-Continent refiners back into the position of playing ruinous competition against each other in bidding for this limited foreign business, but apparently saves the association members from losing gallonage to the nonmember price cutters if they are willing to meet any and all competition as it exists.

Gasoline

The U. S. Motor grade of gasoline was generally quoted at 5¼ cents, but a few

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REFINED MARKET BAROMETER

Lower gasoline prices were posted by eastern seaboard and Mid-Continent refiners during the last week and the announcement that Gulf Coast export prices would no longer be posted by the Export Petroleum Association, Inc., tended to weaken all coastal markets. Natural gasoline was firmly held at last week's price level, with little change shown in the demand. Fuel oils continued to be freely offered, the heavy grades evidencing scattered weakness with price shading practiced where large volumes were traded. All grades of motor oils were being freely offered at last week's price level in all sections, the Pennsylvania and Gulf Coast markets being particularly inactive.

Mid-Continent—Gasoline prices moved to a narrower range, which indicated the market may soon be established at 5 to 5¼ cents. Natural gasoline was firm at 4½ cents. Low cold test fuel oils commanded a premium, but the entire fuel market remained sluggish.

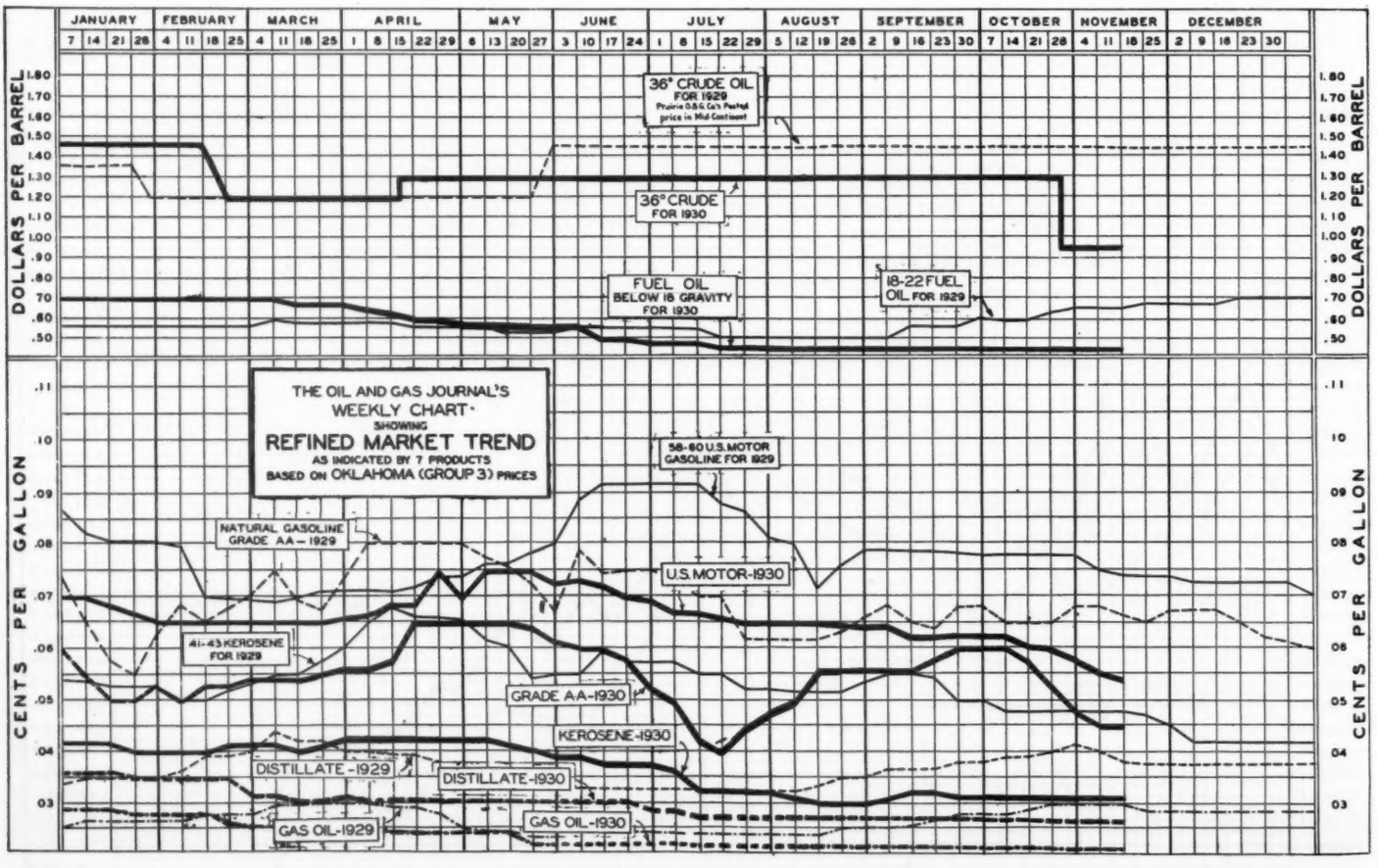
Atlantic Seaboard—Further weakness developed throughout the list of refinery products, but new hopes are being built around the fact that refiners are curtailing operations to more nearly balance production and demand.

Chicago—Favorable weather has stimulated gasoline consumption, but there has been a free offering of all grades at last week's quotations. Fuel oil was traded in in larger volumes and the market was improved in the case of the low cold test material.

Pennsylvania—Still lower prices were posted on several grades of steam refined stock and bright stock. There were no changes in the price level of the light oils.

California—There was no change in the entire price list of refinery products.

Gulf Coast—Weakness in the general market immediately followed the announcement of the Export Petroleum Association that it would no longer post prices on commodities shipped by its members from Gulf Coast points. Several new purchases of gasoline by French buyers then gave new life to hopes of maintaining the present level of gasoline prices. The other products remained unchanged.



Institute Has Frank, Full Discussion

Every Phase of Industry's Present Situation Presented at Eleventh Annual Meeting. No Inharmonious Note

By Andrew M. Rowley

CHICAGO, Nov. 11.—For the first time in the history of the oil business, executives of producing and refining organizations, representing in the aggregate probably more than 90 per cent of these branches of the petroleum industry in the United States, met together here last night; frankly discussed the economic situation of the industry; and considered reports of the committee on economics of the Federal Oil Conservation Board and of the committee of the American Petroleum Institute which showed what each of these branches of the oil business must do between now and April 1 of next year if gasoline stocks on that date are to be held to 40,000,000 bbls, a figure recommended as desirable in each of the reports mentioned.

The meeting was arranged as a part of the eleventh annual convention of the American Petroleum Institute which officially opened at the Stevens Hotel here this afternoon although committees of the Institute have been holding meetings here since last Wednesday and many sessions, including a meeting of the board of directors, were held yesterday. If nothing else is accomplished at this convention, which closes Thursday night with the annual dinner, consensus of opinion is that the joint meeting of producers and refiners last night was the most beneficial for the entire industry of any other meeting or convention ever held. Exactly 249 oil men, including the heads of the largest producing and refining companies in the United States and executives of self-styled small independent concerns attended the meeting last night.

No Inharmonious Note

To the surprise, if not the astonishment, of many present, not one unharmonious note was sounded throughout the meeting which lasted more than three hours. Every man present seemed to realize the entire petroleum industry is facing an emergency; that the recommendations of the committees of the Federal Oil Conservation Board and of the Institute offered a solution of the problem and a way out of present difficulties; and, above all else, that what was good for the industry at large must of necessity be good for each individual company, regardless of its size. No division of opinion was evident on the reports and statements made that to improve the entire situation gasoline stocks on April 1 next year should not exceed 40,000,000 bbls.

To accomplish this an 8.2 per cent reduction starting October 1 last, must be made in the aggregate refining production by straightrun, cracking, natural gasoline, blended, and imports.

Crude Limit Supported

Domestic crude oil production during that six months must be held to an average of 2,333,500 bbls. daily with imports held to an average of 158,700 bbls. daily. The total demand for crude oil during the six months was placed at 2,392,200 bbls. daily of which 2,271,000 bbls. represented runs to stills, 65,900 bbls. daily exports, and 55,000 bbls. daily used for fuel and other purposes without refining.

The estimated daily crude oil demand by districts to bring gasoline stocks down to the desired level, as shown by the Institute's committee report follow: Pennsylvania, 58,000 bbls.; Kentucky, 24,400 bbls.; Lima, Illinois and Indiana, 28,200 bbls.; North Louisiana and Arkansas, 86,400 bbls.; West Texas and New Mexico, 316,300 bbls.; Oklahoma, Kansas and North Texas, 953,700 bbls.; Gulf Coast, 177,800 bbls.; Rocky Mountain, 58,600 bbls.; and California 530,100 bbls.

Figures on crude oil demand and rate of curtailment in refinery operations needed, as contained in the report of the committee of the Federal Oil Conservation Board, published elsewhere in this issue, are based on an estimate of 45,000,000 bbls. of gasoline in storage April 1 next, the report stating, "while around 40,000,000 bbls. of gasoline appears a desirable inventory for next spring, the committee has used 45,000,000 bbls. because of the shortness of the intervening liquidation period and the difficulty of attaining the lower figure."

The gasoline demand during the six months from October 1 last to April 1 of next year is estimated at 208,000,000 bbls. In speaking of consumption, the report of the committee on economics of the American Petroleum Institute states: "The petroleum industry faces, during the six months' period from October 1, 1930, to April 1, 1931, a demand for its products which will reflect the general business depression and it cannot expect, under present conditions, to have the large annual percentage increase in demand for its products which it has enjoyed during past years."

Excess Refining Program

Chaos undoubtedly would reign in the entire industry next year if the program of runs to stills during the six months in question as contemplated by refiners of this country is carried out. Replies received in answer to the recent Institute questionnaire from companies representing 76 per cent of the total potential refining capacity of the country indicate that refiners contemplate running 490,603,000 bbls. of crude oil to stills during the six months' period ending April 1 next. This is at the rate of 2,696,000 bbls. daily. Applying the average yields of gasoline from crude and the estimate of imports of gasoline, this amount of crude would make available 248,686,000 bbls. of gasoline.

The Bureau of Mines reports there are 38,242,000 bbls. of gasoline at refineries on October 1. The returns from the refiners indicate that they contemplate having a total of 52,127,000 bbls. of gasoline on hand at refineries on April 1, 1931. This means the refining industry is anticipating a demand for a total of 234,801,000 bbls. of gasoline or an increase of 14¼ per cent over the demand during the same period of 1929-1930. This is in direct contrast to estimates of the economic committees which figure gasoline demand will not increase or average probably not more than slightly over 1 per cent gain. The subcommittee of the economics committee of the Institute reported that in its belief, if the refiners' program of runs to stills is carried out there will be created an oversupply of gasoline to the extent of 40,686,000 bbls. which, when added to stocks on hand October 1 indicate gasoline stocks at refineries April 1 next of 78,928,000 bbls.

Protest by Producers

Statements made at the meeting left no doubt that crude oil producers are emphatically of the opinion much of the present trouble is due to failure upon the part of the refining industry to do its part in the conservation movement and in efforts to more nearly balance supply with requirements.

Burdette Blue, vice president of the Indian Territory Illuminating Oil Co., of Bartlesville, Okla., told of the heavy sacrifices made by Oklahoma producers; of the success attained in limiting crude oil production in that State; and of the constructive spirit of co-operation which has guided the producing industry there during this period of overproduction. "But," he added, "Oklahoma producers are now asking if the big sacrifices they have made have not to a great extent been rendered valueless and the benefits thrown away by the refiners." He warned the industry crude oil producers must be given some satisfactory assurance the refining industry will not again make futile the sacrifices of the producers if they expect the producers to continue to cooperate in the effort to hold supplies to requirements.

Robert R. Penn, president of the Penn Oil Co. of Texas, seemingly expressed the attitude of the producers when he declared producers of Texas would carry out any program of curtailment recommended as best for the entire industry but that they insisted the time had come when the refiners must do their part and curtail refinery operations to prevent a further piling up of excess stocks of gasoline. He said crude oil production in Texas would be reduced to an average of 705,000 bbls. daily for 60 days beginning November 25 and that the industry could depend upon full co-operation in its efforts to solve its present problems from Texas producers.

Stocks a Menace

K. R. Kingsbury, president of the Standard Oil Co. of California, stated he is quite sure producers in California are willing to curtail to any figure deemed necessary to keep the industry in balance. He mentioned the fact neither of the reports considered at the meeting contemplated any reduction of stocks during the six months' period and said as long as the industry carries present excessive stocks aboveground they constitute a menace. He pointed out also that in considering a figure of 40,000,000 bbls. of gasoline as of April 1 the industry should also consider the potential stocks of gasoline represented in the crude oil now held in aboveground storage.

Walter Miller, of the Continental Oil Co., suggested a simple method of achieving the goal in the matter of gasoline stocks. He pointed out present stocks of gasoline are practically at the figure desired for April 1 and said if the head of each refining company would instruct his refinery production manager not to manufacture any more gasoline than the company was shipping, no company would add any gasoline to storage this winter and stocks would be held at the present level which is the level desired for April 1 next.

Situation Serious

W. S. Farish, president of the Humble Oil & Refining Co., stated the joint meeting of the producers and refiners and the compilation of the reports by the committee of the Federal Oil Conservation Board and of the American Petroleum Institute meant absolutely nothing if those present at the meeting last night and the industry as a whole did not consider the situation most seriously. He pointed out that last year there was considerable discussion of the necessity of holding gasoline stocks to a more conservative level and that there seemed to be a feeling that stocks which then totaled 39,000,000 bbls. of gasoline should not be increased. However, he said, the industry accumulated 16,000,000 bbls. more gasoline in storage within three or four months from the time of all the discussion and started out on April 1 of this year with 55,000,000 bbls. of gasoline in storage.

Wirt Franklin, president of the Wirt Franklin Petroleum Corp., declared production of crude oil in Venezuela should be curtailed on a parity with what is being done in the United States and suggested the ratio of actual to potential production as achieved in Oklahoma be used as a basis for Venezuelan operations. He showed what had been accomplished in Oklahoma and cited the Oklahoma Field as an outstanding example of co-operation on the part of producers, saying that field at the present time is producing only one and thirty-eight hundredths of its rated potential.

William R. Boyd, Jr., executive vice president of the Institute, was enthusiastic at the spirit shown by all at the meeting last night and said the meeting was a challenge to the business ability of the executives of the oil industry. He urged all companies to furnish the Institute with all facts and figures requested in different questionnaires in order that the industry might be informed fully and accurately of conditions. He assured all that such facts and figures would be held in absolute confidence and

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ELECTION OF DIRECTORS

By Andrew M. Rowley

CHICAGO, Nov. 11.—Directors of the American Petroleum Institute elected this afternoon to fill expired terms and those elected by the board of directors of the institute follow: R. A. Broomfield, Barnsdall Oil Co. of California, Los Angeles; L. P. St. Clair, Union Oil Co. of California, Los Angeles; Oscar Sutro, Standard Oil Co. of California, San Francisco; W. S. Farish, Humble Oil & Refining Co., Houston, Tex.; Axtell J. Byles, Tidewater Associated Oil Co., New York; H. R. Gallagher, Shell Oil Co. of California, San Francisco; Roy B. Jones, Panhandle Producing & Refining Co., Wichita Falls, Tex.; Frank B. Fretter, National Refining Co., Cleveland; G. R. Nutty, Gulf Refining Co., Pittsburgh; W. E. Smith, Standard Oil Co. of Kentucky, Louisville; K. R. Kingsbury, Standard Oil Co. of California, San Francisco; L. L. Marcell, White Eagle Oil & Refining Co., Kansas City; Henry M. Dawes, Pure Oil Co., Chicago; E. W. Sinclair, Sinclair Refining Co., New York; J. Howard Pew, Sun Oil Co., Philadelphia; C. H. Kountz, Prairie Pipe Line Co., Independence Kans.; John M. Crawford, Parkersburg Rig & Reel Co., Parkersburg, W. Va.; W. C. Teagle, Standard Oil Co. (New Jersey), New York; C. B. Ames, The Texas Company, New York; Jacob France, Mid-Continent Petroleum Corp., Tulsa; Wirt Franklin, Wirt Franklin Petroleum Corp., Ardmore, Okla.; S. A. Guiberson, Guiberson Investment Co., Los Angeles; W. F. Humphrey, Associated Oil Co., San Francisco; D. J. Moran, Continental Oil Co., Ponca City, Okla.; E. J. Bullock, Standard Oil Co. of Indiana, Chicago; Robert W. Stewart, Chicago; W. G. Skelly, Skelly Oil Co., Tulsa; W. M. Keck, Superior Oil Co., Los Angeles; C. F. Meyer, Standard of New York; J. C. Van Eck, Shell-Union Oil Corp., New York; and George P. Whaley, Vacuum Oil Co., New York.

What Is Outlook for the Oil Industry?

Situation Analyzed by President Reeser at Annual Meeting of American Petroleum Institute. Three Important Factors.

By E. B. Reeser
President American Petroleum Institute*

What is the outlook for the petroleum industry? Millions of stockholders and owners of petroleum securities are tremendously interested in the correct answer to this question.

Whether the world's basic industries are to operate profitably or not is always of vital concern. The recent record of most of our industries—coal, lumber, agriculture, metals, textiles, rubber, for example—has not been encouraging. In common with the rest of them, the petroleum industry lately has been dissipating its capital investment by disposing of its products either at or below cost.

In general, the cause of the difficulty may be stated as due to excess production of either raw material or of manufactured products, or both. Some economists prefer to call it underconsumption; that is, a decline in the demand for the particular commodity below the normal rate of production and without any increase in the quantity produced; in other cases, it has been due to abnormal increases in the quantity produced. It is of the utmost significance that concurrently with the fall in price levels we have witnessed stock accumulations of such commodities as rubber, wheat, wool, coal, cotton, silk, leather and hides, tin, zinc, lead, copper and petroleum.

In the case of petroleum it is undoubtedly true that our instrumentalities of production have been geared high. In truth, in recent years all of our physical instruments whether in crude production, refining or distribution, have been, from an industrial point of view, unduly multiplied. Continual technical progress in percentage output has accompanied this physical expansion. With a capacity output largely in excess of normal increases in consumption, it is easy for the informed to understand how an unsuspected decline in percentage increase of demand could rapidly throw the equilibrium between supply and demand off balance.

The entire world is in the throes of an economic upheaval. The depression is confined to no country nor to any single industry. Business, agriculture and labor alike suffer severely. Agriculture was stricken first. It is a striking illustration of the economic interdependence of nations and of industries.

Mental Adjustment Needed

The answer to the question "what is the immediate outlook for the petroleum industry?" would depend upon two things; namely, the rapidity with which general business conditions improve and the ability of the producers, refiners and marketers which compose our industry, to adopt their mental operations and company policies to the changed conditions under which we must operate. In my judgment, the latter is the more important of the two. I believe the common sense of the men engaged in the petroleum industry is equal to the test.

Momentarily, the demand for petroleum products is not keeping pace with production, but for the petroleum industry there is one underlying factor of safety; namely, that the foundation of our present day industrial life rests upon petroleum in some form. Petroleum is the source of power and lubrication for the motor car, truck and bus; for the stationary internal combustion engine and the moving locomotive and tractor, for the ships which fly in the air and sail the seven seas. It is, therefore, certain that petroleum products will relatively be in ever increasing demand. The point of a permanently saturated market is far removed.

But let us in the industry not be lulled into any false sense of security by the broad vista of future demand nor be deceived by the golden glow of the high sun upon the canvas. No one need have fear for the fundamental soundness of the petroleum industry as such. It is a restoration of prosperity for men and units engaged in the industry we must presently seek. To find that, each of us must face facts as they are in order to determine things as they ought to be. We should and must apply to the oil business the same sound principles of economics that we should apply to the fluctuations in the market for wheat, cotton, cattle, coal, silk or any other of the world's staple necessities.

*Before Eleventh Annual Meeting American Petroleum Institute, Chicago, Ill.

What Fixes Price Level

Every study of the law of supply and demand requires primarily a study of the relationship of the quantity of a raw material or of a given product available for market and the demand for that material or product. Now, supply means that quantity of a product which sellers are ready to dispose of at a price. Demand is what somebody wants, backed by financial ability to buy plus an offer to buy at a price. The relationship between the available supply and the demand and not the cost of the product is what fixes the price level. Cost may affect the price but it does not determine it.

When one sells below his cost of production, he is dissipating his capital and sooner or later, if he continues to do so, he must inevitably fail in business. If he sells above his costs, he makes profits and succeeds in business. All of this not only sounds elementary, but it is. Nevertheless, it is the simply stated rule which every man who is both an oil and a business man should follow; namely, to produce no more crude nor refine any more products than he can currently sell at a profit.

Stocks of crude and refined petroleum products above ground constitute, in the last analysis, available supply ready for the market at some price. Every barrel in excess of actual working stock required as a reserve margin of safety in operation is actual excess supply. It is what the economist would probably call the "marginal increment," and should be reduced at the earliest expedient opportunity. With knowledge of the existing condition of supply and demand, no economic reason can be found, no plausible excuse manufactured to justify continuous additions to petroleum stocks. Knowing the law of trade, how can any oil man give any satisfactory reason for our adding to storage each and every day for the 11 years just passed, an average of about 124,900 bbls. of petroleum and its products? Liquid stocks on January 1 1919, were 187,312,000 bbls.; on January 1, 1930, they were 689,181,000 bbls. The burden of overproduction is not on the consumers but on the producers, and what a tremendous cost and loss have been incurred as a result of this industrial policy of stock accumulation.

Staggering Load

Industry everywhere fairly staggers under its load of surpluses of all kinds of raw material. The wise industry, the wise producer, the wise manufacturer is liquidating his marginal or excess reserve stocks to the point of safety as rapidly as conditions will warrant, meanwhile halting his production operations to current requirements.

Before normal conditions can be restored in the petroleum industry, indeed in any industry, it is essential that those engaged in the business know the industrial situation and apply the law of cause and effect. As Justice Holmes has aptly said in one of the supreme court's antitrust law decisions: "I should have thought that the ideal of commerce was an intelligent interchange made with a full knowledge of the facts as a basis for a forecast of the future on both sides."

Surveys Prepared

Two independently prepared surveys of the petroleum situation have been presented during this meeting and later will be available in printed form for every oil man. One is the report of a survey made by the Committee on Petroleum Economics of the Federal Oil Conservation Board; the other the report of a survey made by the institute's special committee on the economic situation. These reports cover the crude oil and gasoline situation with a forecast for the six months' period ending April 1, 1931. These two surveys provide for units engaged in the business, the only available consensus of informed opinion on which to base a forecast of the future; he who is guided thereby in his operaitons contributes to the recovery from the depression in which our industry finds itself.

Every executive and every individual should realize that success and prosperity are based primarily upon the prosperity of the industry itself. No individual can possibly achieve permanent success if exclusive reliance is to be placed upon individual effort. The forces marshaled against him are altogether too great. This is a time when the constructive cooperative effort of all is essential if the industry is to profit from its full possibilities during the coming year.

Overproduction, as I have used the term and as it is being generally used to refer to the plight of every industry, means surplus of products over current consumption. We, however, have with us the continuing tendency and ability to overproduce petroleum products, and our difficulty is intensified many-fold by the legal obstacles to concerted control of our activities.

The President of the United States, in 1924, recognizing the enforced competitive conditions under which the petroleum industry was obliged to operate, pointed out that the present methods of capturing our oil deposits were wasteful to an alarming degree in that it became impossible to conserve oil in the ground under our present leasing and royalty practices if a neighboring owner or lessee desired to gain possession of his deposits. Then, as now, conditions surrounding oil production were such that we faced overproduction. The President publicly recognized that overproduction in itself encourages cheapness and disregard of essential values.

Tribute to Oil Producer

Since the creation of the Federal Oil Conservation Board, however, much water has gone over the dam. The then theory of conservation as applied to crude petroleum has now become an accepted policy in the industry and this is the factor which has made it possible to formulate, with the aid of local government authorities, proration or curtailment programs. It is a tribute to the oil producer that so large a portion of our discovered reserve supply of crude is being held underground in its natural storage reservoir. The enactment of the

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RE-ELECTION OF PRESIDENT REESER FOR THIRD TERM SEEMS ASSURED

CHICAGO, Nov. 11.—E. B. Reeser, president of the Barnsdall Corporation and for the past two years president of the American Petroleum Institute, will be re-elected president of the institute at the convention here this week unless all signs fail. Reluctant to accept the honor for another year, entailing as it does so much of his time and energy, Mr. Reeser made a valiant effort to have another selected for the coming year, even going so far as to ask that directors who were his friends not vote for him. But it seems he is a far better oil company executive and president of the institute than he is a politician for he has steadily lost support in his effort to have the directors choose someone else for the job of president. As one prominent director stated: "Ed Reeser says no one who is really his friend will vote for him for another term as president. I count myself as one of his friends and want to continue so but I certainly am going to vote for his re-election."

President E. B. Reeser

The strong feeling for Mr. Reeser's re-election may be gauged from the fact several directors who seemed to have a prejudice against the third term idea decided they would rather forget this prejudice in this instance than have Mr. Reeser step out of the position of president of the institute at this time. The general sentiment seems to be: "Any man who could hold that job during the past two years with conditions as they have been, make the progress which has been made, not step on anyone's toes too hard, and still maintain the support and co-operation of the big majority of the industry—well, we better hold that fellow."

Working Chart for the Winter Months

Committee on Petroleum Economics Recommends Operations to Limit Gasoline Stocks to Safe Supply March 31

WASHINGTON, D. C., Nov. 10.—Secretary of the Interior Ray Lyman Wilbur, as chairman of the Federal Oil Conservation Board, has made public a report submitted to this board by the volunteer committee on petroleum economics, of which Joseph E. Pogue, of New York, served as chairman. This report, embracing a national survey of potential national petroleum requirements, etc., for the period October 1, 1930, to March 31, 1931, was rendered by reason of unanimous request by the board of directors of the American Petroleum Institute on October 3, last.

A report of similar character was made by this volunteer committee on petroleum economics on March 25, last. Membership of the original committee consisted of J. Elmer Thomas, chairman; Joseph E. Pogue, secretary; Ray M. Collins, H. W. Lowrie, Jr., and H. P. Grimm. When request for a second report was made Mr. Thomas was in Europe, but cabled his proxy to Mr. Pogue who, with the other members of the original committee, immediately undertook the survey, completing the report today in time for its consideration by members of the American Petroleum Institute now assembled at Chicago in annual convention.

The report follows:

Introduction

This report is a supplement to the committee's report of March 25 and is prepared at the request of the Honorable Ray Lyman Wilbur, chairman of the Federal Oil Conservation Board. The purpose of the report is to survey the supply and demand factors in the petroleum industry for the six months ending March 31, 1931, to discuss the allocation of crude oil requirements for this period to the principal producing areas, and to analyze the bearing of the imports of crude oil and its products upon the domestic situation.

Conditions in the Petroleum Industry

The petroleum industry entered the current business depression with excessive plant capacity, large inventories, and an enormous drilled up potential supply of crude oil. During the first six months of the depression, the demands for petroleum products were only moderately retarded and thus the curtailment schedules in effect in the industry were sufficient to keep supply and demand in approximate balance, although unfortunately no material progress was made toward the liquidation of inventories or in the reduction of drilling and capital expansion. In the late spring, however, the aggravated severity of the business depression led to a much more adverse decline in oil consumption, until in the summer the demand for gasoline and for all oil products had fallen approximately 7 per cent below the levels considered normal for that period. This supplementary drop in consumption, together with the uncertainty of the duration of the lower figures, creates a new and perplexing problem for the petroleum industry to meet, and additional curtailment of both refinery operations and crude oil production.

In pointing to the need for further curtailment of current supplies, the committee feels that there may exist in the industry considerable misunderstanding as to the role of supply curtailment and the benefits to be derived from such action. It perhaps should be stated that curtailment of current supply is in the nature of an emergency measure and should not be expected to provide a cure for the fundamental economic maladjustments existing in the petroleum industry, which arise from the circumstance that this activity is overdeveloped, overcapitalized, and rests upon an unsound method of competitive offset drilling. Curtailment of production alone cannot remedy these conditions; to reach the root of the difficulty will require restriction of drilling, abridgement of plant expansion, and a modernization of the prevailing method of crude oil production to place this department of the business in low-cost brackets and on a competitive basis with the rest of the world. Curtailment of supply, however, is essential to sustain the industry pending more fundamental adjustments, but the difficulties involved in curtailment of supply should not be permitted to obscure the larger issue with which this report, by definition, is not directly concerned.

The committee desires o point out further that the Kettleman Hills and Belridge areas of California have enormous potentialities for the manufacture of low-cost gasoline and unless these areas are promptly brought under a plan of unit operation, much more drastic restrictions in refinery operations and crude oil production than are shown in this report will be required in all other districts. These areas, if competitively drilled, have the capacity for perpetuating overproduction for a considerable period.

Method of Approach

The problem of estimating the crude oil requirements of the country must be approached through an analysis of the prospective consumption of gasoline, the principal product of crude petroleum, and a translation of the gasoline demand into the domestic crude oil needed to provide the necessary gasoline. The problem is complicated by the impossibility of accurately gauging future demand at a time of acute economic unsettlement, as well as by the variations possible in the volume of components that go to make up the gasoline supply. To meet these difficulties a range of estimates is presented which will serve to show the great significance of relatively small differences in demand and the leverage effect of changes in the supply of cracked and imported gasoline, and from this range the most probable figures may be selected.

The past statistics used in this report and employed as a basis for the calculations are taken from the published reports of the Petroleum Division of the United States Bureau of Mines.

Demand for Gasoline

The consumption of gasoline in recent months has been sharply diverted downward from its normal course by the business depression. To forecast the demand for gasoline over the next six months in consequence requires a specific knowledge of the trend of business activity during that period. The basis for an accurate forecast of business over the near-term future is not available and therefore a dependable prediction of gasoline consumption cannot be goven. In major depressions, however, so far as evidence is available, gasoline consumption is drastically affected and shows a lag of several months in following business activity, both on the downturn and on the upturn. During the third quarter of the year, gasoline consumption was running about 7 per cent below a level calculated as normal, and with the business outlook still obscure the prospects for a favorable gasoline demand during the period under consideration are not promising. In the absence of a basis for precision, a range of demands from a decrease of 4 per cent to an increase of 4 per cent has been forecasted and this spread seems likely to include the actual developments. See Table 1. Present evidence is suggestive that demand is apt to run toward the central or lower measures of this range.

To translate this demand range into supply quotas requires the selection of a gasoline inventory objective for the end of the period, March 31, 1931. The American Petroleum Institute has recently ascertained through questionnaires that an adequate gasoline working stock for September 30 is 29,000,000 barrels, which when adjusted for natural gasoline is reduced to 27,200,000 bbls. Seasonally corrected, the latter figure becomes 38,800,000 bbls. on March 31. While around 40,000,000 bbls. therefore appears a desirable inventory for next spring, the committee has used 45,000,000 bbls., because of the shortness of the intervening liquidation period and the difficulty of attaining the lower figure. In Table 1, however, the calculations has been made on the basis in turn of 40,000,000, 45,000,000 and 50,000,000 bbls. so that the effect of varying inventory assumptions may be observed.

It may be read from Table 1 that a break-even demand, with an inventory objective of 45,000,000 bbls. for next spring, will require a curtailment of 7

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TABLE 1—REFINERY CURTAILMENT NECESSARY TO MEET VARYING DEMANDS FOR GASOLINE DURING THE SIX MONTHS ENDING MARCH 31, 1931
(In millions of barrels)

Gasoline demand six months ending Mar. 31, 1930 (bbls.)	Assumed change in demand per cent	Indicated demand six months ending Mar. 31, 1931 (bbls.)	Supply at estimated October rate (bbls.)	Change in stocks* (bbls.)	Curtailment of gasoline supply from est. Oct. rate to result in stocks on March 31, 1931 of 40 mill. bbls. per cent	45 mill. bbls. per cent	50 mill. bbls. per cent
208	—4	200	230	+30	—12	—10	—8
208	—2	204	230	+26	—10	—8	—6
208	0	208	230	+22	—9	—7	—5
208	+2	212	230	+18	—7	—5	—3
208	+4	216	230	+14	—5	—3	—1

*Stocks September 30 were 38.3 million barrels.

TABLE 2—EFFECT UPON DOMESTIC CRUDE OIL CONSUMPTION OF VARYING RATES OF GASOLINE DEMAND, ASSUMING GASOLINE STOCKS OF 45,000,000 BBLS. ON MARCH 31, 1931, AND ALL CURTAILMENT OF GASOLINE SUPPLY (FROM THE ESTIMATED OCTOBER RATE) CONFINED TO STRAIGHTRUN REFINING
(Period covered: Six months ending March 31, 1931)

Per cent change in gasoline demand from previous year	Required runs of crude oil to stills thous. bbls. daily	Indicated curtailment from estimated October rate per cent	Domestic crude oil required thous. bbls. daily	Indicated curtailment from October 18 rate per cent
—4	1,950	—20	1,910	—20
—2	2,040	—16	2,000	—16
0	2,130	—12	2,090	—12
+2	2,220	—8	2,180	—8
+4	2,310	—4	2,270	—4

TABLE 3—EFFECT UPON DOMESTIC CRUDE OIL CONSUMPTION OF VARYING RATES OF GASOLINE DEMAND, ASSUMING GASOLINE STOCKS OF 45,000,000 BBLS. ON MARCH 31, 1931, AND CURTAILMENT OF GASOLINE SUPPLY (FROM THE ESTIMAED OCTOBER RATE) APPLIED ON THE SAME PERCENTAGE BASIS TO ALL SOURCES OF GASOLINE
(Period covered: Six months ending March 31, 1931)

Per cent change in gasoline demand from previous year	Required runs of crude oil to stills thous. bbls. daily	Indicated curtailment from estimated October rate per cent	Domestic crude oil required thous. bbls. daily	Indicated curtailment from October 18 rate per cent
—4	2,220	—8.5	2,180	—8.5
—2	2,270	—6.5	2,230	—6.5
0	2,310	—4.5	2,270	—4.5
+2	2,360	—2.5	2,320	—2.5
+4	2,410	—0.5	2,370	—0.5

TABLE 4—EFFECT UPON ALLOCATION OF CRUDE OIL CONSUMPTION OF VARYING RATES OF GASOLINE DEMAND, ASSUMING GASOLINE STOCKS OF 45,000,000 BBLS. ON MARCH 31, 1931, AND CURTAILMENT OF GASOLINE SUPPLY (FROM THE ESTIMATED OCTOBER RATE) APPLIED ON THE SAME PERCENTAGE BASIS TO ALL SOURCES OF GASOLINE
(Period covered: Six months ending March 31, 1931)
(In thousands of barrels per day)

Area—	Suggested percentage allocation Per cent	Suggested allocation basis following changes in gasoline demand —4%	—2%	0	+2%	+4%
California	23.9	521	533	542	555	567
Oklahoma	23.9	521	533	542	555	567
Texas	32.1	700	716	730	745	761
Others	20.1	438	448	456	465	475
Total United States	100.2	2,180	2,230	2,270	2,320	2,370

TABLE 5—SUGGESTED COURSE OF GASOLINE AND CRUDE OIL STOCKS FROM AUGUST, 1930, TO MARCH, 1931, TO INSURE GASOLINE INVENTORIES OF 45,000,000 BBLS. ON MARCH 31, AND NO INCREASE IN CRUDE OIL STOCKS
(In millions of barrels)

1930—	Gasoline	Crude oil
September	*38.3	*521
October	37.6	521
November	38.2	521
December	40.2	521
1931—		
January	43.1	521
February	44.6	521
March	47.0	521

*Actual.

TABLE 6—RELATION OF IMPORTS TO TOTAL SUPPLY OF ALL OILS

Data From U. S. Bureau of Mines
(In thousands of barrels per day)

	Imports	Total supply	Per cent imported
1925	214	2,384	9.0
1926	223	2,426	9.2
1927	197	2,778	7.1
1928	250	2,837	8.8
1929	295	3,209	9.3
1929 (9 months)	304	3,235	9.4
1930 (9 months)	298	2,970	10.0

TABLE 7—IMPORTS OF CRUDE PETROLEUM PRODUCTS INTO THE UNITED STATES, 1925-1930

Data From U. S. Bureau of Mines
(In thousands of barrels per day)

	Crude petroleum	Gasoline	Other petroleum products	Total imports
1925	169	10	35	214
1926	165	16	42	223
1927	160	14	23	197
1928	218	11	21	250
1929	216	24	57	297
1929 (1st 9 months)	230	22	52	304
1930 (1st 9 months)	175	49	74	298
1930 August	163	59	81	303
1930 September	194	51	69	314

TABLE 8—COMPARISON OF IMPORTS AND EXPORTS OF CRUDE PETROLEUM PRODUCTS, 1925-1930

Data From U. S. Bureau of Mines
(In thousands of barrels per day)

	Imports	Exports	Net exports
1925	214	311	97
1926	223	360	137
1927	197	386	189
1928	250	423	173
1929	297	447	150
1929 (9 months)	304	435	131
1930 (9 months)	298	447	149
1930 August	303	483	180
1930 September	314	357	43

New Research Program Being Planned

Engineering Committees Spend Busy Week at Institute Meeting. Much Practical Work Accomplished

By L. G. E. Bignell
Petroleum Engineering Editor

CHICAGO, Nov. 11. — At the annual meeting of the American Petroleum Institute last year a change was made in the set up in the divisions handling the details of engineering work and the results of this change are being made evident at the eleventh annual meeting of the institute now in progress in Chicago. Three major divisions covering production, refining and marketing were created last year and each of these divisions is holding group sessions this year with papers of great importance to the industry being presented at each meeting.

Preliminary to the technical sessions there has been much work done by the various committees who are dealing with specific subjects and some of these committee meetings were held November 5 and others have met each day since then, including Sunday, discussing the special problems they have under advisement.

Several of the groups have prepared very complete manuals containing recommendations and suggestions for the handling of the details of the particular problem under consideration such as the manual on disposal of refinery wastes which will be in two editions, the first of which is now in finished and published form, and the second is being prepared. The committee on disposal of refinery waste first met November 7 and has held six meetings since and much has been accomplished on this very important subject. The constructive work done by the refinery waste committee has inspired similar activity by the committees dealing with production and marketing wastes and these committees have under construction manuals dealing with their specific problems which will be published shortly as a result of the work done at the many sessions held here.

Fire Prevention

Fire prevention is likewise being handled by committees representing respectively the refineries, marketers and producers' divisions and they contemplate reducing their recommendations to manual form shortly. The benefits to be derived by such work on the part of men who are actively engaged in this type of activity for various companies affiliated with the A.P.I. are obvious and it may be said that the committeemen without exception have given their best efforts to the problems and have devoted much time to long sessions and the spirit of co-operation and construction is very much in evidence in all committee sessions at this annual meeting.

Because time was not available on other days before the group sessions met on Wednesday many committees held their meetings on Sunday and in every case these sessions were full time and devoted to most constructive work. Many of the committeemen have served the institute for several years and there is little lost motion in their proceedings and, guided by able chairmen, they are getting results that should be of much value to the industry at this time, as well as assisting in future development.

New Research Program

The five-year research program financed through funds donated by John D. Rockefeller and the Universal Oil Products Co. will end June 30, 1931, and much has been accomplished by the work done under this program. To benefit by this work and co-ordinate and continue it new funds will be necessary to finance a program of research and committees from the divisions of production and refining have been actively at work during this meeting formulating reports to be submitted to the committee of the Board of Fundamental Research. Specific problems were outlined and definite lines of procedure recommended as well as a tentative budget prepared by these committees and it is hoped that the research board will later accept these recommendations and the institute appropriate funds to carry on this very essential work which will be of great value to the industry as a whole especially in view of the changed conditions now existing.

Corrosion Studies

Corrosion has played a very important part in the work of the engineers connected with the institute and several very able papers were presented at the group sessions as well as constructive work done by the committees. Reports of progress of the co-operative plan of testing now being carried on by the Bureau of Standards engineers for the manufacturers and pipe line companies to determine the value of protective coatings were made by Dr. Gordon N. Scott and Dr. K. H. Logan of the Bureau of Standards as well as interesting papers by W. H. Thornhill, for the underground pipe protection institute, on soil corrosion by J. F. Putnam of the Standard Oil Co. of California, and Dr. Stanley Gill, chairman of the subcommittee on production corrosion. Doctor Gill's paper deals with the economic phases of corrosion briefly and recommends the collection of additional data on this phase of the problem and specifically outlines many of the phenomena that contribute to corrosion of oil field equipment and correlates much of the existing data on these subjects and is a real contribution to the literature on corrosion.

Many of the production, refinery and marketing group papers are published in this issue of The Oil and Gas Journal and the discussion following their presentation was spirited and added much on these subjects.

There can be no doubt in the minds of anyone attending meetings such as held here this week of the active part being played by engineers in all branches of the industry at this time, and their work and recommendations indicate very clearly that they have in mind the economic as well as the mechanical or chemical phases of the many problems under consideration.

While there is some discussion as to the possibility of district meetings playing a more important part in next year's engineering program, there seems no doubt but that the work to be done during the ensuing year will be of great value to the industry, for with unit operation and its allied problems coming to the front at this time the engineer in every company has a full share of work ahead of him and the developments of engineering problems at this annual meeting will serve him well in solving them, while if the board of directors appropriates funds for special research work to be started immediately much new data will be made available for application at a time when it will be urgently needed in solving some of the industry's new and vexing problems.

Shell Offers Reduction in Venezuela

Says California and Gulf Output Now Offsets Venezuelan Shipments. Renews Proposal of January Last

By Andrew M. Rowley

CHICAGO, Nov. 10. — The following statement was issued here today by F. Godber, director, Royal Dutch-Shell group, and Shell Union Oil Corp.:

"Considerable misunderstanding seems to have arisen in regard to the imports by the Shell Union of petroleum products from Venezuela. Certain interested parties who have apparently not taken the trouble to analyze the figures in order to secure for themselves the true position are claiming that imports from Venezuela are largely responsible for the present very low prices on the domestic market. We cannot speak for other importing companies, but we do know that these imports, so far as the Shell Union is concerned, have no bearing upon the domestic market.

"The facts are that Shell Union has a distributing organization on the East Coast of the United States, which it has built up to provide an outlet for its production in California and the Gulf Coast. This contemplated, in line with the policy of other American companies, the shipment by sea of supplies to the East Coast so that in addition to the gasoline marketed on the Pacific Coast and the midwestern and Gulf markets, its entire sales organization throughout the United States would be supplied with gasoline produced from crude obtained and refined in its entirety within the United States. Certain freight disadvantages to this plan, however, induced us to ship our California and Gulf supplies to Europe and elsewhere instead of to the East Coast and to import in substitution, approximately equivalent quantities from Venezuela to the East Coast so that, in effect, an exchange gallon for gallon of Venezuelan for American oil took place and the domestic market remained unaffected. This is quite clear because if, as has been suggested, our imports of Venezuelan gasoline were to be diverted to Europe and our California and Gulf supplies shipped to the East Coast, the net quantities marketed by us in this country would remain the same.

"It seems, however, that, although the facts are well known to most interested parties, a persistent campaign has been launched to mislead the public so far as our group is concerned. For many years past, the group, with which Shell Union is associated, has consistently advocated conservation and has continually drawn attention to the inevitable consequences of the reckless and irrational development of the industry. The Royal Dutch-Shell has not only reduced its own production in the United States considerably below the decline for the country as a whole—the figures for California showing a decline of 32.1 per cent as compared with a decline of 21.7 per cent for the State as a whole; and for the Mid-Continent, Texas and Gulf Coast, a decline of 17.4 per cent as compared with a decline of 7.4 per cent for these States as a whole—but in addition the Royal Dutch-Shell has shut in very substantial quantities in Venezuela, Rumania, Dutch Indies and Mexico, amounting in all to not less than 18,000,000 bbls. per annum, and if their proposals to conserve production in Venezuela had been proceeded with, they would have shut in a further quantity of 16,100,000 bbls. per annum.

"It is quite obvious, therefore, that this group has already made sacrifices considerably in excess of most other companies in an endeavor to create more normal conditions within the industry as a whole. It still believes that substantial benefits to the public and to the industry can be realized within the near future if those interested in the industry will approach their problems from a broader angle, and whilst it is quite clear that so far as this group is concerned, a rearrangement or a reduction of imports can not affect the domestic market, it is willing, in order to still further prove its desire to co-operate and to remove the prejudices which undoubtedly have been created, and subject to its being able to make satisfactory freight arrangements, to substantially reduce its imports of Venezuelan gasoline by approximately half the requirements of its East Coast organization, so that to this extent the quantities of California and Gulf gasoline, which hitherto have been shipped to points outside of the United States, will during 1931 be shipped to the East Coast; whilst to the same extent Venezuelan gasoline, which has been imported to the East Coast organization. will be shipped direct to other points to take the place of the California and the Gulf products.

"The Royal Dutch-Shell group continues in the strong belief that the crux of the whole situation is, that oil should be produced only within the limits of the demand, and that not only should crude oil come within this definition, but that refined products also be similarly included. For its part, it recognizes the efforts which have already been made in the United States and other countries, to which reference has already been made, and so far as the production in Venezuela is concerned, it reiterates its offer made almost 12 months ago that, provided other producers in Venezuela will accept the same undertaking it is prepared to reduce its rate of production from fields in Venezuela compared with the rate of production in 1929 proportionately with any average reduction in the United States on the same basis. This offer has never been withdrawn, and it is clearly evident that the efforts of producers within the United States will be largely nullified unless production in Venezuela is similarly and proportionately reduced.

"It is interesting to note that, if this offer had been accepted in January of this year, when it was made by the Royal Dutch-Shell group, the production from Venezuela would already have been reduced by many millions of barrels for the year and the whole oil proposition would, in consequence, have been considerably improved."

Col. Donovan Discusses Antitrust Laws

Suggests How Oil Industry May Get Legal Position Clarified. Law Not to Destroy Business

By Col. William J. Donovan*

I have been asked to discuss before you the antitrust laws. This subject is an important one for every industry that is national in scope. It is particularly important for your industry, which also deals with a natural resource that is a vital motive force in time of peace and an essential element of national defense in time of war.

Few industries have had to consider so many serious questions as you have been called upon to deal with during the past few years. Some of them you have had in common with other industries, but others are peculiar to your own.

In meeting these problems, the American Petroleum Institute is performing a unique task. It is a forum of discussion. It affords a means of common counsel. It mobilizes the opinion and the intelligence of your industry in seeking a solution of your problems. By the presentation of the conditions of the industry to the general public, it will give a better understanding of its underlying difficulties. Already this institute has stimulated the growth and the development in your industry of a consciousness that the companies which compose it are integrated parts of an entire industry which, as a whole, must meet and overcome its problems.

Legal Questions Involved

In the discussion of your problems, inevitably you are brought to the legal questions involved, and at the forefront of many of these questions stands the Sherman Antitrust Act and its supplementary statutes.

America was born in the atmosphere of the philosophy of extreme individualism. But after nearly a century of experience under that doctrine, it was found that the absence of restriction by law had been taken advantage of for a conscious and deliberate development of a method of industrial organization which aimed at the elimination of competition. Since that industrial development was national in scope, action by the federal Government became necessary. The Sherman law was designed to prevent the concentration of wealth and power in the hands of a few, to bring into the federal system of law the restrictions upon the use of property already existing in the common law of the several states in regard to monopolies and to enact into our federal law the competitive principle.

Today there are many criticisms of the Sherman act. Labor finds fault with it not only because of alleged discrimination in its application, but also because it hampers them in their efforts at collective bargaining. Some business men request its repeal or modification because they claim that it is too restrictive upon industry and prevents the working out of business plans in the interest of industry and the public. Economists challenge the theory of the competitive principle upon which the Sherman law is based and point to the present economic depression and overproduction as proof of the failure of that principle.

Industry Must Regulate Self

We may have reached a point where attempts will be made to modify the economic policy of the Sherman law and to substitute some form of government control. And it is exceedingly important to have that borne in mind by this industry, as well as by other industries in considering the repeal or modification of the Sherman law. It must be recognized that people will not permit the unregulated and uncontrolled operation of a great industry under monopolistic conditions, particularly an essential industry. This is exemplified by government control of railroads and our public utilities generally. Industry would have to pay a price for the change or modification of the antitrust laws, and that price might well be the surrender to greater participation and control by Government itself. But it is easier to get the Government into business than it is to get it out. If this is to be avoided it remains for industry to prove its ability to so regulate itself as to make any such change unnecessary.

Col. William J. Donovan

However that may be, we are still dealing with a law that is based upon a principle deeply embedded in the economic and political structure of the country. Whether the operation of this rule of competition is wholesome may be debated, but it is the settled law of this country and still confronts your industry.

The question which I shall discuss is whether this law will prevent the solution of your recurring problem of curtailing production for the purpose of preventing a tremendous oversupply inimical alike to the general welfare and a healthy condition in this most essential industry and for the further purpose of serving the public interest by the conservation of a natural resource.

Law and Conservation

In the field of production it has many times been pointed out that there is a very basic cause for the failure of orderly production. It lies in the common law rule that the owner of the surface has the right to recover from his land all the oil that it will yield, whether originally it underlay his land or flowed there from adjacent lands by reason of his opening and operating a well on his own property. This inevitably results in a race to produce without regard to the demand.

To remedy this condition, you are working out a method of co-operative development and operation of oil pools. This method has presented practical difficulties in its application as well as constitutional questions under the statutes in the oil-producing states. But although you are successful in accomplishing complete unitization, you will still have the problem of overproduction throughout the country resulting from competition among pools.

It has been suggested that federal legislation should be enacted which would limit and prescribe the oil production of this country. There is as yet no unanimous demand for such legislation and it affords no means by which you can meet the present emergency.

This problem of nation-wide overproduction presses upon you now. It is immediate. You are concerned not with a particular theory or an ultimate legal principle. You are faced with a concrete situation.

Legality of Co-operation

The definite question is this: Under existing law, can the competing companies in the industry enter into an agreement to curtail the drilling and production of oil for the purpose of meeting a crisis in overproduction, conserving a wasting natural resource and protecting the investment in the industry.

In this discussion I shall not attempt

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*Before eleventh annual meeting of American Petroleum Institute, Chicago, November 11.

What's the Matter With the Industry

Judge Ames Answers the Question and Declares Producers of Oil and Gas Have the Remedy for All the Ills

By C. B. Ames
Vice President of The Texas Company*

Over a period of years, the demand for petroleum and its products will exceed the supply. At the present time the supply exceeds the demand. The problem of the industry is to flatten out the curve so that supply and demand may be continually kept in a reasonable state of balance. With the exception of a few flush pools the producers of the United States are today giving away their crude oil, that is to say, the price they are receiving does not more than pay the cost of production, if costs are figured on a proper accounting basis. The product itself, therefore, while exhaustible and irreplaceable, is yielding the producer no return, and in some cases a minus return. This is a problem which has for a long time been receiving the attention not only of the industry itself but of the Federal Government and the authorities of the oil producing states. An effort to analyze the situation and an examination of the remedies which have been proposed may not be without value, and, for the purpose of the analysis, the situation may be considered in the light of the producing, refining and marketing phases of the industry.

Progress in Production

During the past few years remarkable progress has been made in the production of crude oil. Great skill and intelligence have combined with large expenditures of capital in discovering oil at greater depths and in devising machinery and methods for recovering it, so that today much of the production which is burdening the industry is coming from horizons more than a mile below the surface of the ground, which only a few years ago were thought to be beyond the reach of the drill.

The open flow tests which are being taken from time to time as the basis for proration show a very large volume. But these tests are for an insufficient time to establish the actual potential. It is conservatively estimated, however, that the actual potential is at least double the demand. This excess of supply over demand is the cause of all the trouble in the industry today.

Improved Refining Methods

Much progress has likewise been made in refining efficiency. As gasoline is the most valuable product of refining, much of the industry's ability has been devoted to improving recoveries, so that now the industry as a whole is converting into gasoline approximately 40 per cent of the crude, whereas 15 years ago the gasoline recovery was only 20 per cent. Even so, the refining industry as a whole is inefficient, as the recovery of gasoline by the general use of the methods now known can be increased to fully 60 per cent, thus reducing by a very great amount the necessary requirements of crude.

Oversupply of Fuel Oil

Today the industry, in order to produce the requirements of gasoline, is producing an enormous quantity of fuel oil which has so flooded the market as to bring an entirely inadequate price and to displace coal in many instances where coal could be profitably used. This has not only been an onerous burden on the petroleum industry but it has likewise been one of the causes for the depressed condition of the coal industry, which in turn, has deprived the railroads of a large volume of freight. This unfortunate condition of the refining industry is directly caused by the overproduction of crude.

Least Progress in Marketing

Of all the branches of the petroleum industry, marketing is in the worst condition, and in it there has been the least progress. The code of marketing practices has been helpful, but there has been such an enormous oversupply of products that the marketing end of the business has almost broken down. The sales departments of the various oil marketing companies and the independent wholesalers and retailers of gasoline seem to be engaged in a mad struggle for volume without regard to either value of the product, or profit in its distribution. It is not unusual for the oil companies to produce crude, transport it to their refineries, refine it, and sell the gasoline for less than some of the dealers receive for distributing it through their stations. In some cases we have even seen marketers offer a discount to customers who will buy on credit instead of paying cash, and it is not unusual for great ingenuity to be displayed in devising methods of complying with the letter of the code, while violating its spirit. This chaotic condition in the marketing business is the direct result of the overproduction of crude.

Remedies—Applied and Proposed

Let us now turn to an examination of some of the remedies which are being applied and which have been proposed:

Proration is the most effective remedy

(Continued on Page 86)

*Before Eleventh Annual Meeting of the American Petroleum Institute at Chicago, November 12, 1930.

Natural Gas Factor in Oil Market

Lessened Demand for Fuel and Gas Oil in California With Exceptionally Low Prices in Pacific Coast Territory

By C. O. Willson

SAN FRANCISCO, Calif., Nov. 10.—The rapid expansion of natural gas facilities in Central and North California centering in this city is creating a situation in oil markets not unlike that which has developed in the Mid-Continent and Middle West due to the building of major pipe lines to the large consuming centers of the latter area.

This particular section of California has had natural gas available a little over a year. During the past few months the initial supply has been augmented with additional pipe lines sufficient to take care of practically all the fuel requirements, both domestic and industrial.

The immediate effect has been a lessened demand for fuel oil and gas oil resulting in a weak market with exceptionally low prices which have spread to all parts of the Pacific Coast territory. As interpreted by representative observers, it will mean changes in refinery operations with expansion in cracking facilities to take care of the lessened demand for fuel oil and gas oil, a development which in turn means a smaller demand for crude oil. Reflecting this situation one large refining organization which previously had not engaged in cracking has completed plans for the construction of cracking units at its local refinery with an initial capacity of 10,000 bbls. daily.

As explained by the executive of one marketing company, the Kettleman Hills Field from which the bulk of the natural gas is being obtained, is highly important not only from the standpoint of a large potential supply of crude oil from which 85 per cent straightrun gasoline is obtainable, but also due to the unlimited supply of fuel gas.

Large Fuel Market

The San Francisco section and the entire Pacific Coast area with the exception of the southern part of California centering in Los Angeles has been a large user of fuel oil and gas oil for many years. Practically all of the large and small industries in Central California have been using fuel oil as fuel for the generation of power. On a more limited scale the same has been true in Oregon and Washington.

In addition there has been a large demand for either fuel oil or gas oil in the manufacture of natural gas. Previous to the advent of natural gas, the major public utility serving this territory was distributing approximately 20,000,000,000 feet of artificial gas yearly. The company was one of the largest buyers of fuel oil on the Pacific Coast as it also used fuel oil in the generation of steam for electrical power.

In addition to the industrial and artificial gas demand, several oil companies had built up a substantial demand for furnace oils used as fuel in homes, apartment houses, hotels and similar commercial buildings.

Much of this business has been taken by the distributors of natural gas and a rapid expansion is assured for the next two years. Although no definite announcement has been made it is assumed that in the near future the natural gas trunk lines will be extended to serve the large consuming centers to the north as far as Washington. If this materializes natural gas facilities will cover all the territory in which the bulk of the fuel oil output of California refineries is consumed leaving only the marine trade and outlets along the coast and other points long distant from the refinery locations.

The two distributors of natural gas in this territory are having little difficulty in securing connections with domestic and industrial customers. In the domestic end, the Pacific Gas & Electric Co. had approximately 500,000 consumers of artificial gas in San Francisco and nearby points. With the artificial gas the consumption was largely confined to cooking. Due to the greater economy with natural gas this is now being extended to heating. In this extension the natural gas comes into competition more with coal than oil as a survey showed that less than 5 per cent were using furnace oils while 75 per cent were using coal and wood.

In this section no trouble is being experienced in replacing coal with natural gas. Due to the long hauls, coal retails

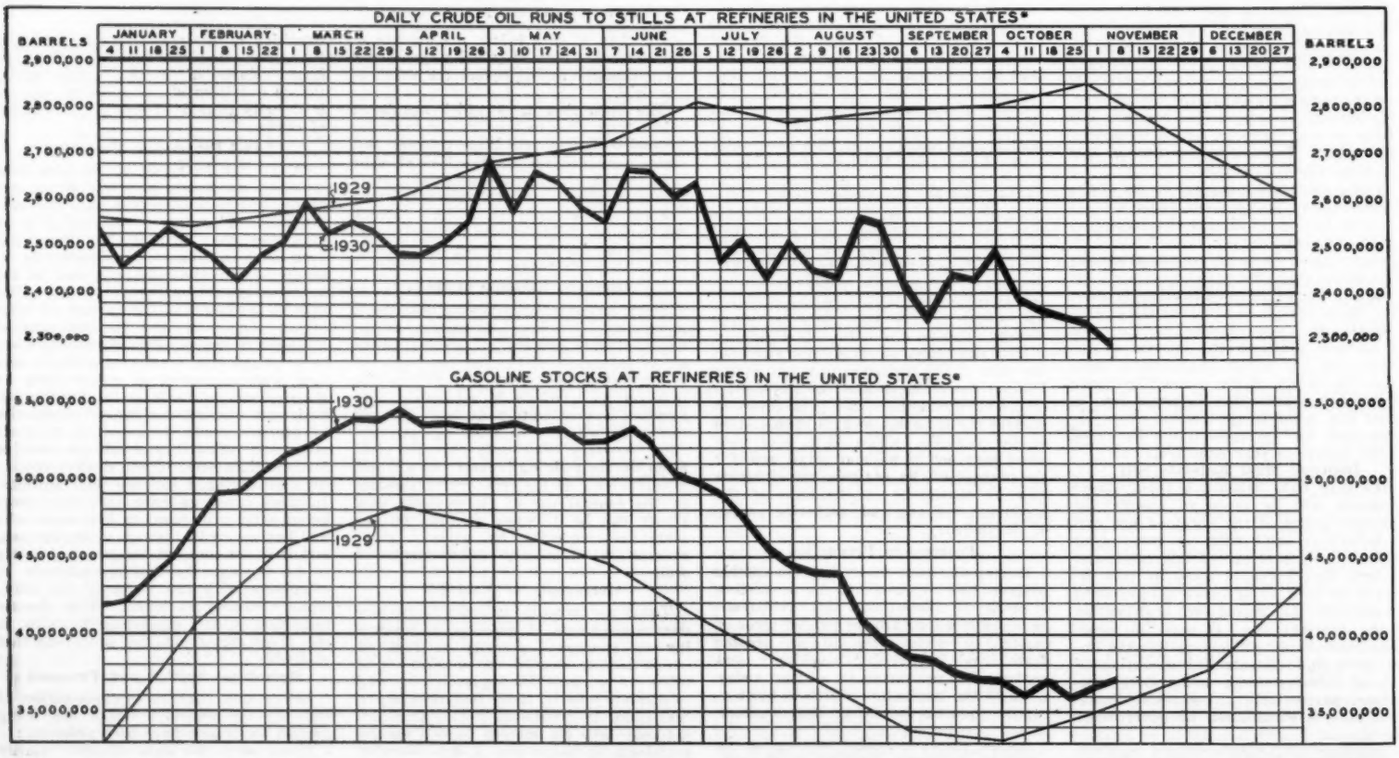
(Continued on Page 227)

AMERICAN PETROLEUM INSTITUTE WEEKLY REFINERY STATISTICS

The weekly report made to the American Petroleum Institute on refinery statistics—crude runs to stills, gasoline stocks and gas and fuel oil stocks in barrels—for the week ending November 8.

	Week ending November 8				Week ending November 1				Week ending January 4			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
East Coast	100.0	482,000	5,705,000	11,878,000	100.0	479,000	5,766,000	12,280,000	100 0	454,857	5,998,000	7,431,000
Appalachian	93.2	73,400	824,000	990,000	93.2	76,100	820,000	1,029,000	91.6	75,571	1,282,000	805,000
Indiana, Illinois, Kentucky	97.5	236,900	4,471,000	3,946,000	97.5	235,700	4,628,000	3,991,000	98.6	289,800	5,483,000	3,505,000
Oklahoma, Kansas, Missouri	89.4	248,100	2,215,000	4,577,000	89.4	241,000	2,384,000	4,601,000	87.7	263,428	3,604,000	3,277,000
Texas	91.9	522,300	6,450,000	10,558,000	91.9	510,500	6,562,000	10,449,000	90.7	539,857	6,590,000	13,757,000
Louisiana and Arkansas	98.3	148,600	1,217,000	2,062,000	98.3	160,700	1,041,000	2,252,000	96.8	160,000	2,161,000	4,499,000
Rocky Mountain	93.1	44,300	1,532,000	1,027,000	93.1	46,900	1,622,000	1,041,000	93.3	41,614	2,273,000	973,000
California	98 3	519,000	14,598,000	103,982,000	98.3	531,700	14,392,000	103,983,000	99.2	642,857	14,826,000	109,770,000
Total United States	95.6	2,274,600	37,012,000	139,020,000	95.6	2,281,600	37,215,000	139,626,000	95.4	2,468,285	42,217,000	144,017,000
Texas Gulf Coast	100.0	410,300	5,242,000	7,787,000	100.0	388,400	5,275,000	7,636,000	100.0	429,585	5,579,000	10,792,000
Louisiana Gulf Coast	100.0	106,300	991,000	1,105,000	100.0	106,600	815,000	1,301,000	100.0	108,514	1,877,000	3,818,000

(1) Per cent of refinery capacity represented. (2) Daily crude runs to stills. (3) Gasoline stocks. (4) Gas and fuel oil stocks.



*Data for 1930 based on weekly reports of the American Petroleum Institute. Data for 1929 derived from monthly reports of the Bureau of Mines, Department of Commerce. Figures for last week not shown in graph but are included in above tables.

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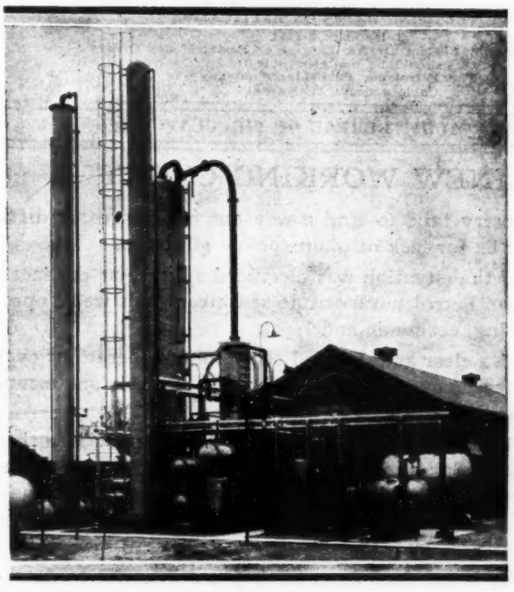

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THE NEW WORKING CHART

If the oil industry fails to find a way out of its present difficulties it will not be for lack of plain spoken guidance.

Every phase of the situation was discussed frankly at the meeting of the American Petroleum Institute at Chicago this week, operating, manufacturing, economic and legal.

More than that, a clear and detailed chart for its operations over the winter was offered covering both production of crude and manufacture of gasoline.

President E. B. Reeser struck the keynote when he declared that the most important requisite is "the ability of the producers, refiners and marketers to adopt their mental operations and company policies to the changed conditions under which the industry must operate."

"Each," he said, "must face facts as they are in order to determine things as they ought to be. Every barrel above actual working stock required is excess supply. No economic reason can be found, no plausible excuse can be manufactured to justify continuous additions to petroleum stocks."

It is too often forgotten in the oil business that, as he said, it is "the relationship between the available supply and the demand, and not the cost of the product that fixes the price level." If this were more generally understood and excess production regarded as price cutting there might be more care in avoiding overproduction.

It was to this end that the Committee on Petroleum Economics at the request of the Chairman of the Federal Oil Conservation Board made out last March a working score sheet for the industry. Unfortunately the industry was slow in applying this chart to its operations but enough progress was made by the producing division to bring crude production to a level with demand at the close of the season of largest gasoline consumption, and by the manufacturing division to some extent though lamentably far from sufficient.

This was the more regrettable because as a result of the condition of general business the demand for petroleum products has not maintained its normal increase. That slowing in consumption makes it almost certain that the demand for gasoline during the winter will not exceed that of a year ago and even may be less.

Consequently there was urgent need for a revision of the chart and at the request of the American Petroleum Institute the Oil Board's Committee on Petroleum Economics has made public a series of calculations as a guide for operations between now and March 31 next.

The American Petroleum Institute, through questionnaires, has ascertained that an adequate working stock of gasoline on March 31 would be 40,000,000 barrels. The Oil Board Committee suggests 45,000,000 barrels as a limit.

The question is then, what production of crude and of gasoline will keep within that limit?

It is known that the demand for gasoline and petroleum products has fallen 7 per cent below normal. In October the industry was geared to supply that 7 per cent larger demand than actually existed.

Obviously, if the demand between now and March 31 is to be no greater than a year ago the production of gasoline will have to be curtailed 7 per cent from the October rate of output.

If the entire reduction were made in straightrun refining this would limit domestic crude oil requirements to 2,090,000 barrels daily.

But the Committee suggests the curtailment in operations might better be extended to cover all sources of gasoline. On a basis of an even percentage reduction on the various sources of gasoline this would require a domestic crude oil production of 2,270,000 barrels daily.

Allowing, however, for what has been produced above this limit to date, would reduce the crude requirements to 2,240,000 barrels daily which is apportioned 535,000 barrels daily each to California and Oklahoma, 719,000 barrels daily to Texas and 451,000 barrels in all other states.

To attain the Institute limit of 40,000,000 barrels by March 31 a reduction in gasoline production of 8.2 per cent from October 1 would be necessary.

It is interesting to note that the Committee's calculations are based on no change in crude stocks which it regards as far too large, but practically impossible of liquidation this winter. For the future the committee favors a reduction of crude oil stocks at the rate of 100,000 barrels daily for an indefinite period. Even at that rate it would take seven years to cut the domestic stocks of crude in half.

If these remedies are considered drastic it must be recognized that the situation requires heroic treatment.

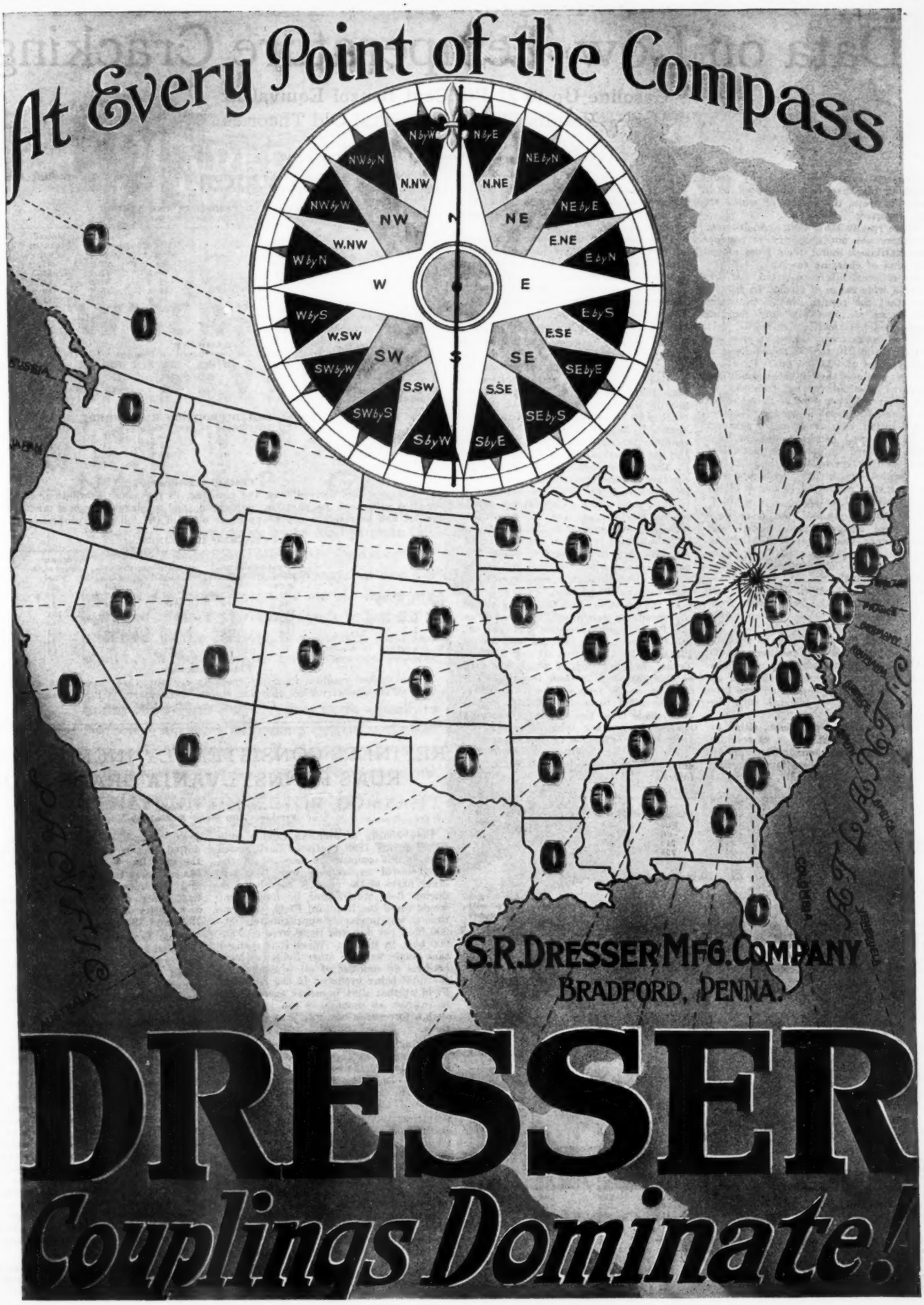
Primarily, of course, the trouble has been overproduction of crude, but the producers have done and are doing their utmost to curtail. Manufacturers have made progress towards curtailing their output of products but the slackening in demand was outside their calculations. They now have to take that into account in their operations during the winter if they are to start the summer season right.

A point of timely importance in Judge C. B. Ames' address was that the overproduction in the oil industry has contributed to the general depression of business by cheap fuel oil affecting the coal industry and in turn the railroad industry in lessening coal traffic. His conclusion that the waste of gas must be stopped is becoming increasingly clear. If the industry fails to check it other means may be found as wider markets are entered and a larger public interest is aroused.

The antitrust law, Colonel Donovan holds, was "not intended to destroy business but to protect it." It would seem if an agreement were made in good faith for the purpose of maintaining a stable condition and for the purpose of overcoming the business disasters and depressions which come from periods of excessive production a very persuasive argument is offered to the court for holding that the effect upon prices is indirect and remote and that the agreement does not fall within the prohibitions of the act.

This, at any rate, sounds like the rule of reason.

No more practical general meeting of the Institute has ever been held, providing a real matching of minds where everyone had full and free opportunity to discuss all angles of the situation. It was a thorough presentation of the facts in the situation of today which President Reeser in his opening address said every individual in the industry must face and order his operations accordingly.


At Every Point of the Compass
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Data on Low Temperature Cracking

Gasoline Up to 71 Per Cent Benzol Equivalent Made. Results Challenge Several Old Theories

By Gustav Egloff and E. F. Nelson
Universal Oil Products Co. Research Laboratories, Chicago, Ill.

Theories long held by many about cracking oil have been disproved by a series of tests, the results of which are here reported.

These results show that excessive temperatures are not necessary to produce high antiknock motor fuels from almost any kind of charging stock.

Six different oils were tested, and they cover a wide range of stocks. In fact, so wide that the results can be translated into terms of practically any charging stock used by American refiners.

These stocks were cracked at pressures ranging from 210 to 350 pounds, and at temperatures of 925° to 967° F.

They produced under these conditions yields of gasoline varying from 53 per cent to over 78 per cent of the charging stock, and the gasoline produced showed knock rating varying from 54 per cent to 71 per cent benzol equivalent. The Ethyl standard by the same method of motor testing corresponds to a 59 per cent benzol equivalent. The knock rating tests were conducted by means of the "Ethyl series 30 motor."

The oils upon which the tests were made were Pennsylvania kerosene and Pennsylvania gas oil, representing the paraffin hydrocarbons; Mid-Continent fuel oil and Mid-Continent gas oil, representing semiasphaltic or mixed base crudes; Mount Pleasant, Michigan, fuel oil, semiasphaltic; and heavy crude from the Refugio Field of Texas, a naphthenic oil.

The Mount Pleasant crude, as generally known, produces a gasoline of exceedingly aggravated knocking characteristics. However, by cracking the fuel oil a high knock rating motor fuel was produced, which can be blended with the straightrun.

In the cracking of petroleum, either as heavy crude, as distillate, or as residual fuel oil, it has been thought necessary to vary the process of operation according to the stock to be cracked.

This theory has been particularly strongly held when the oils to be cracked differed in chemical characteristics; that is, as to paraffinic, naphthenic or semiasphaltic origin.

However, these tests show, as a matter of fact, that the same process and the same mode of operation in the same cracking unit produced successful results from the six oils mentioned, not only from the standpoint of yield but from that of antiknock quality as well.

Mode of Operation

The cracking process in each test was operated by the flashing method. The charging stock was pumped through the heating coil with the reflux condensate from the dephlegmator. The hydrocarbon mixture during its travel through the coil reached an elevated oil temperature under pressure. The pressure on the reaction chamber ranged from 210 to 350 pounds and the temperature from 925° F. to 967° F. The hydrocarbon mixture leaving the reaction chamber passed into a flash vessel wherein separation into vapors and residue took place. The vapors passed into a fractionator, and the condensate therefrom was pumped to the heating coil to be subjected to further cracking in admixture with fresh charging stock. The gasoline vapors leaving the top of the tower passed through a cooling coil and then to a receiving tank.

In the accompanying tables are shown the results of laboratory tests made on the Pennsylvania kerosene and gas oil, Mid-Continent fuel and gas oil, Mount Pleasant, Michigan, fuel oil and Refugio, Texas, crude oil, each of which was used as charging stock in these test runs. The table below the tests on the stock shows, in convenient form, the quality of gasoline made from the respective charging stocks. In another table is shown the yield of gasoline made in each case.

The operating conditions for the different cracking stocks are tabulated as follows:

	Oil Source					
	Pennsylvania		Mid-Continent		Mount Pleasant	Refugio heavy
	Kerosene	Gas oil	Fuel oil	Gas oil	Fuel oil	crude oil
Pressure (lbs.)	350	350	210	350	250	300
Temp. °F. (average)	950	952	925	967	945	950

YIELD OF GASOLINE MADE

	% of cracking stock	Init.-End B.P. °F.	% Benzol equiv.	% Iso-octane mixed with n heptane
Pennsylvania kerosene	78.5	93-364	60	75
Pennsylvania gas oil	73.7	94-380	60	75
Mid-Continent fuel oil	53.1	106-391	58	73
Mid-Continent gas oil	70.0	84-392	64	80
Mount Pleasant fuel oil	63.8	94-404	54	68
Heavy Refugio crude	64 2	86-427	71	89

ANALYSIS OF CHARGING STOCKS

	Pennsylvania		Mid-Continent			Mt. Pleasant (Michigan)
	Kerosene distillate	Gas oil	Fuel oil	Gas oil	Refugio crude	topped crude
A.P.I. Gravity	45.0	37.6	26.2	25.3	23.2	30.8
Flash (Cleveland) °F.	140	160	275	225	185	225
Fire (open cup) °F.	165	185	310	255	210	250
Flash (Pensky-Martin) °F.	130	140	260	210	170	205
Furol Vis. @ 77°F.	9	10	56	10	14	17
Cold test —°F. Below	0	25	55	10 Below	0	35
B.S and water—%	0	Trace	0.4	Trace	Trace	0 6

QUALITY OF GASOLINE MADE

I.B.P. °F.	322	372	482	448	388	436
% Distilled over—	°F.	°F.	°F.	°F.	°F.	°F.
10	384	490	556	488	446	490
20	398	530	598	504	478	528
30	413	560	631	516	504	560
40	429	583	663	529	530	600
50	447	607	687	546	558	650
60	464	629	694	562	596	686
70	484	652	703	585	646	696
80	507	676	711	615	714	708
90	552	710	722	664	736	716
95	607	740	735	710	754	718
E.P.	649	767	749	731	760	730
% Recovery	99.0	99.0	96 0	98.0	98 0	96.5
% Coke by weight	.....	.....	3.4	.....	.....	3 0
% Over @ 410° F.	28.5	2.0	0.0	0.0	5.0	0.0
% Over @ 437° F.	44 0	3.5	0.0	0.0	8.0	0.0
% Over @ 572° F.	92.0	35.0	13.5	64.0	54.0	33.0

The gasoline, flashed residue and gas yields derived from cracking the various charging stocks, are tabulated as follows:

CRACKED PRODUCTS AND YIELDS
(Based on charging stock)

	Oil Source					
	Pennsylvania		Mid-Continent		Mount Pleasant	Refugio heavy
	Kerosene	Gas oil	Fuel oil	Gas oil	Fuel oil	crude oil
Gasoline %	73.6	69.5	50.3	65.2	61 2	61.2
A.P.I. Gravity	60.4	62.0	59 8	61.0	60 9	45.4
Flashed Residue %	7 5	12 0	42 6	15.1	30 6	28.3
A.P.I. Gravity	8 8	9.1	14 9	7.0	11.0	....
Gas (cu. ft. per bbl.)	689	630	362	698	391	604
Gasoline content of gas per 1,000 cu. ft. (gal.)	3.6	2.8	3.2	2.9	2 8	2 1
GASOLINE (Total per cent based on charge)						
Gasoline in storage tank	73.6	69.5	50 3	65 2	61.2	61 2
Gasoline derived from gas %	4.9	4 2	2.8	4.8	2 6	3.0
% Gasoline based on charge	78.5	73.7	53.1	70.0	63.8	64.2
TOTAL LIQUID PRODUCTS RECOVERED (Per cent based on cracking stocks)						
Gasoline %	78.5	73.7	53 1	70.0	63 8	64 2
Flashed residue %	7.5	12.0	42 6	15.1	30 6	28.3
Total liquid recovery %	86.0	85.7	95.7	85.1	94.4	92.5
Gas, loss %	14.0	14.3	4.3	14.9	5.6	7.5

Cracked Gasolines

The gasolines derived from the cracking, in the same installation, of highly diversified oils, such as paraffin, naphthene, and semiasphaltic base and distillates, fuel oil and as residues and heavy crude oil, had the following properties:

CRACKED GASOLINES

	Fuel Source					
	Pennsylvania		Mid-Continent		Mount Pleasant	Refugio heavy
	Kerosene	Gas oil	Fuel oil	Gas oil	Fuel oil	crude oil
A.P.I. Gravity	60.4	62.0	59.8	61.0	60.9	45.4
Init. B.P. °F.	93	94	106	84	94	86
20% over at °F.	182	176	190	166	192	216
50% over at °F.	264	256	273	252	284	333
End B.P. °F.	364	380	391	392	404	427
Benzol equiv.	60	60	58	64	54	71
% Iso-octane in n-heptane	75	75	73	80	68	89

Flashed Residue

The flashed residues from the cracking operation are superior in quality, from a fuel oil standpoint, to the charging stocks. Particularly is this true of the heating

(Continued on Page 188)

REFINERS CONSISTENTLY INCREASE RUNS PENNSYLVANIA GRADE CRUDE

By Ralph T. Zook,
President the Sloan & Zook Co.*

In a history of McKean County published during 1898 Professor Carll stated that in his opinion on account of the unsuccessful exploration work done in other parts of the country no other producing field would ever be found that would equal the Bradford Field. At that time it was producing approximately 60,000 bbls. per day and there were 36,000,000 bbls. in storage. When it is realized that single wells in other fields can now produce an amount of oil equivalent to the total being produced in the Bradford Field at that time it makes one hesitate to express an opinion of the future—if such a forecast is based on present conditions.

During 1920 the total Pennsylvania production was approximately 54,000 bbls. daily and the consumption the same amount. In 1924 the production had decreased to 48,000 bbls. and the consumption to 47,000 bbls.

During 1923 leaders in both the producing and refining divisions formed the Pennsylvania Grade Crude Oil Association to advertise Pennsylvania Grade oil and the lubricants made therefrom. The success of this campaign is shown very conclusively in a graph of production and consumption. While during 1924 the average consumption was 46,000 bbls., this increased to 66,000 bbls. for the first nine months in 1930.

A study of the graph in relation to price changes is very interesting. The dotted line is one of consumption and the solid line is one of production. The shaded areas indicate additions to stocks and the open areas withdrawals. The first years of this graph are squashed as a matter of convenience and only 1928, 1929 and 1930 are shown by months.

From January to June of 1928 production and consumption were about in balance and the price remained stationary at $3 per barrel; from June, 1928, to January, 1929, heavy withdrawals were made from stocks and the price advanced until a maximum of over $4 per barrel was reached. From then until June both production and consumption increased and while there were slight additions to stocks, the consumption was increasing at such a rapid rate that it no doubt seemed advisable by the purchasers to hold the price constant. It was during June, 1929, that production exceeded consumption and from that time until August, 1930, additions to stocks were made and the market reflected this condition.

This graph shows conclusively that the law of supply and demand and that only sets the price of crude. As to how many barrels of oil must go into storage or how many must be taken from storage before a change in price is made is of no consequence—as stocks are added to, prices go down and as withdrawals are made prices go up.

During April of this year it was realized the production in the Bradford and

(Continued on Page 189)

*Presented at Petroleum and Natural Gas conference, School of Mineral Industries, State College, Pennsylvania.

PENBERTHY PRODUCTS

WHERE SERVICE IS SEVERE USE THE PENBERTHY NAVY TYPE GAGE

THE Penberthy Navy Type Gage is recommended for pressures up to 300 pounds. Its dependable operation results from its exceptionally rugged design, careful workmanship and the fact that it is made from new metal. These are important reasons why this gage is so generally preferred in the refinery, the natural gasoline plant . . . in fact, wherever conditions are severe.

These characteristics are not peculiar to the Penberthy Navy Type Gage . . . they apply equally to Penberthy injectors, lubricating devices and other types of Penberthy gages. Penberthy Products are carried in stock by supply companies everywhere.

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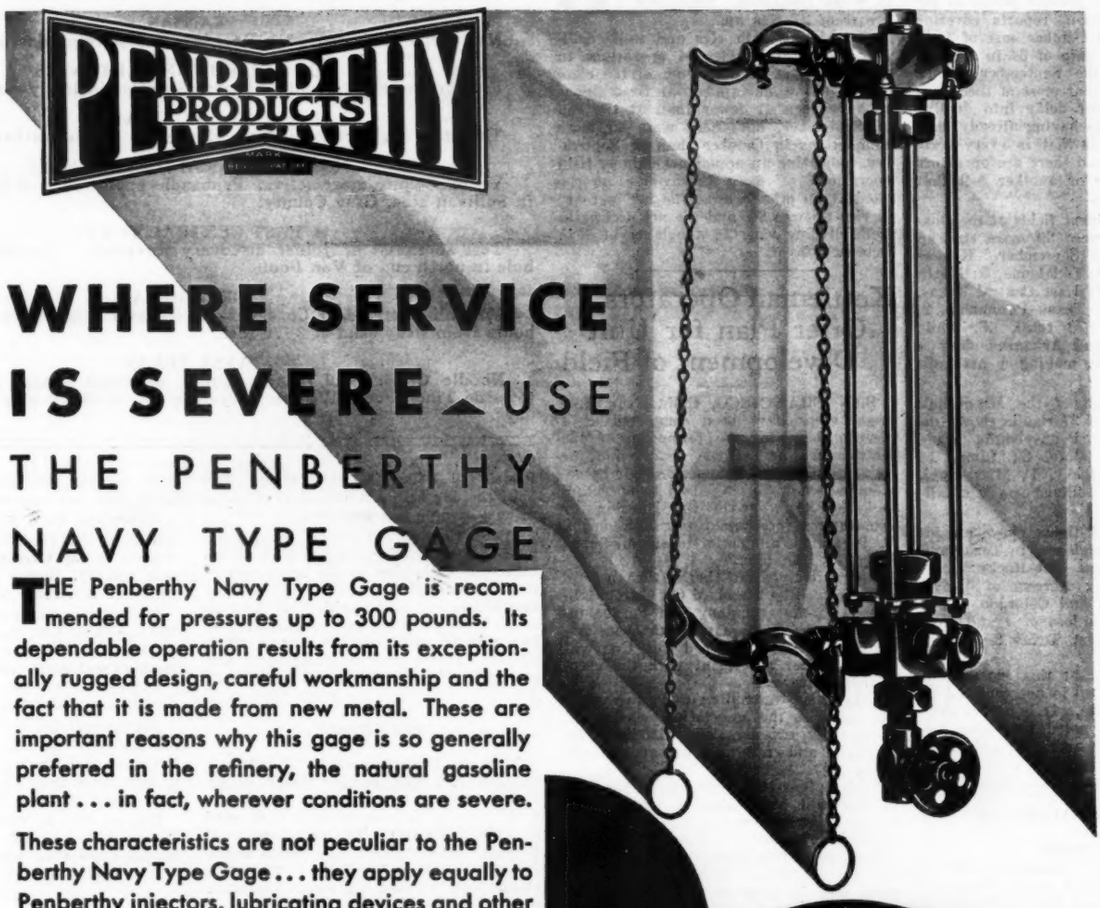

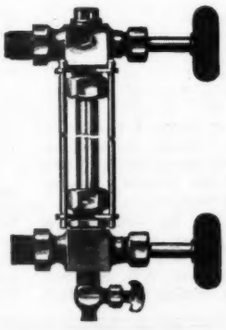

NO DECLINE IN FIELD WORK IN OCTOBER, MONTHLY REPORT SHOWS

Notwithstanding the continued efforts of government agencies, conservation movements, unitization adherents and others in the industry to curtail field operations during the present period of potential overproduction, reports covering field operations in October east of California show a net gain of 64 in rigs up, as compared to the September report. As it is presumed that most of these rigs will develop without delay into drilling wells, some of them having already done so, the indication is that in every state where oil is produced there are operators who for one cause or another feel that they must carry on.

In the Mid-Continent fields at the close of October there were 39 more rigs up than at the end of September. Kansas shows a gain of 10; Oklahoma, 5; North Central Texas, 14; East Central Texas, 4; East Texas, 1; Texas Panhandle, 2, and West Texas, 7; total, 43, while North Louisiana and Arkansas show a decrease of 2 each, making a net gain of 39.

In the fields east of the Mississippi River an increase of 27 rigs is shown divided as follows: Pennsylvania grade fields, 3; Central Ohio, 3; Lima, 1; Michigan, 13; Kentucky, 1; Mississippi, 7; total, 28, while Indiana shows a falling off of 1 rig.

The Gulf coastal fields show an increase of 5, 1 of which was in Texas and 4 in South Louisiana. The Rocky Mountain area had a net decrease of 5 rigs, Montana gaining 3 and Colorado 1, but Wyoming showing a loss of 4 and New Mexico 5. Southwest Texas fields had a drop of 2 in rigs.

It is significant that this increase in the number of rigs up is not confined to any one field or state. It is almost general, as it will be noted that only Indiana, in the eastern area, and Arkansas, Colorado and Wyoming in the West are the only states in which there was a decline in rig building. North Louisiana's defection is overbalanced by the increase in South Louisiana. Texas had a net increase of 27 rigs up.

Considering both rigs and wells drilling, the total number of operations in the fields east of California at the close of October would appear at first glance to have been 41 fewer than at the end of September, but there were 45 more completions in October than in September, indicating an actual net gain in field operations of 4 in the course of the month. In other words, the net increase in rigs up was 64, and the net decline in wells drilling was 60, a balance of 4 in October's favor.

OIL MAN'S CALENDAR

NOVEMBER

13-14—Chicago, American Oil Chemists' Society, Congress Hall.

21—Birmingham, Ala., Alabama Oil Men's Association, Tutwiler Hotel.

DECEMBER

1-5—Memphis, Tenn., ninth annual Asphalt Paving Conference, Hotel Peabody.

2-4—Omaha, Neb., convention, Nebraska Independent Oil Men's Association, Paxton Hotel.

3-4—Indianapolis, Ind., Indiana Petroleum Association, Hotel Severin.

8—New Orleans, La., American Institute of Chemical Engineers.

JANUARY

3-10—New York, National Automobile Show.

10-16—St. Louis, Mo., twenty-eighth annual convention, American Road Builders Association.

14-15—Minneapolis, Minn., Minnesota division, Northwest Petroleum Association, Radisson Hotel.

19-23—Detroit, Mich., annual meeting, Society of Automotive Engineers, Book-Cadillac Hotel.

24-31—Chicago, National Automobile Show.

29-30—Grand Forks, N. Dak., North Dakota division, Northwest Petroleum Association, Dacotah Hotel.

FEBRUARY

16-21—San Francisco, National Western Metal Congress and Exposition.

MARCH

19-20-21—San Antonio, Tex., American Association of Petroleum Geologists, Gunter Hotel.

MAY

4-9—Charlotte, N. C., Good Roads Convention.

Kettleman Operators Offer Plan for Unit Development of Field

SAN FRANCISCO, Calif., Nov. 8.—Legal steps have been completed at a meeting here for the formation of the Kettleman North Dome Association for unit development of the field. The agreement will now be submitted to operators and the Secretary of the Interior for signatures before actual operations begin. It is stated all major operators have agreed to the plan.

Approximately half the Kettleman acreage is owned by Standard Oil Co. of California, so that company will not be included in the Kettleman North Dome Association. The Standard Oil Co. will operate under agreement with the association, however.

Companies controlling remaining acreage comprise the association, which will prorate its expenses and distribute its products and revenues on an acreage basis.

Under plans being formulated, needless drilling will be eliminated, all holdings will be fully protected and the field's output adjusted closely to demand of market.

The association likely will assess members for operation expenses and development now in progress probably will be taken over and profits prorated.

By-laws and other details of formation of the association and plans for operation are being worked on and further details will be announced later.

Late Fields

KANSAS

E. B. Shawver's No. 1 fee, SE cor. SW SE Section 18-27-2, in the Eastborough Pool, Sedgwick County, Kansas, pumped 252 bbls. the first 12 hours from the chat.

Plains Oil Co. and others' No. 1 in Section 11-27-1w, Sedgwick County, west of Wichita, on Shell Petroleum Corp.'s acreage, was drilling in chat 3,112-28 feet with nothing showing. Operators were preparing to lower the 8-inch casing to drill deeper.

E. B. Shawver's No. 1 Robbins, C NW SW Section 21-28-1, Robbins Pool, Sedgwick County, is a new location with material moving in. It is located southeast of the discovery well in the Robbins Pool.

The deepest drilling test in the State was fishing for tools at a total depth of 6,909 feet. Watchorn Oil & Gas Co.'s No. 2 Morrison, NW cor. NE Section 20-32-21w, Clark County, is expected to reach the 7,000-foot level before being completed.

Noble Drilling Co. and others' No. 1 Zerger, NW cor. NE SE Section 16-21-3w, south of Voshell Pool, in McPherson County, cored from 2,980-3,005 feet, and was preparing to lower the casing to resume coring. The chat is expected in the test around this level.

In the northeast part of Barton County, Syndicate Oil & Gas Co. and others' No. 1 Peirano, in Section 4-16-11w, was drilling at 2,720 feet, offsetting the discovery well recently completed by the Prairie Oil & Gas Co., which pumped 200 bbls. the day before it was shut in owing to lack of pipe line facilities.

Work, Connell and others' No. 1 Freeman, NE cor. NW Section 19-27-2, which extended production in the north end of the Eastborough Pool, was given a short production test and swabbed at the rate of 35 bbls. an hour, and is estimated to be a 600-bbl. well from the chat at 2,996-97 feet. If the well is produced it will cause six offsets to be started in the pool.

High Spots in Field News

GULF COAST
Well on Barbers Hill west flank flows 2,267 bbls.

ROCKY MOUNTAIN AREA
Eastern edge of southeastern end of Hobbs Field found.

KANSAS
New wells in Eastborough Pool increase state production.

NORTH LOUISIANA-ARKANSAS
Five dry holes in Zwolle district. Surprise in Holly district.

CALIFORNIA
Threat of high-grade oil from Kettleman forces further curtailment.

NORTH TEXAS AND PANHANDLE
Young County most active. Panhandle operators wish separate proration in Sullivan area, Gray County.

EAST CENTRAL TEXAS
Test southeast of Joiner discovery threatens to become dry hole. Dry hole in north end of Van Pool.

OKLAHOMA
Magnolia Petroleum Co.'s well in Konawa Pool flows 3,213 bbls. in 12 hours from stray sand at 2,776 feet.

WEST TEXAS
Noodle Creek Pool, Jones County, extended almost a mile northwest towards Tiner Pool. Winkler proration cut to 60,000 bbls. and extended 90 days.

OKLAHOMA

Magnolia Petroleum Co.'s No. 2 Wood, SE cor. NE SW, Section 29-8-6, Seminole County, in the Konawa Pool, flowed 3,213 bbls. in 12 hours from a stray sand at 2,696-2,776 feet. The producing sand is above the Cromwell sand which is the regular producing horizon in the area. Other tests to find the stray producing sand were the Magnolia Petroleum Co.'s No. 1 Wood and the Sinclair Oil & Gas Co.'s No. 1 Caesar in the same district.

Actual production from the Oklahoma City Pool for the seven days ending November 10, showing the number of barrels produced, number of wells on production, and the total number of wells completed in the pool, were as follows:

Date—	Bbls.	Wells prod.	Wells comp.
November 4	90,980	73	641
November 5	90,980	73	641
November 6	84,066	71	641
November 7	70,432	74	642
November 8	47,697	60	644
November 9	74,151	60	645
November 10	62,840	52	645

Continental Oil Co.'s No. 1 Lavington, C SE SE, Section 32-21-1w, Noble County, found 13,000,000 feet of gas at 3,398-3,410 feet with 1,300 pounds pressure. The well has been shut in.

The deepest test in the south end of the Oklahoma City Pool may be a dry hole. Sinclair Oil & Gas Co.'s No. 7 School Land-67, NE cor. NW SE, Section 36-11-3w, was drilling at 7,365 feet, with nothing showing. It was tested at 6,500 feet, but was dry.

Gypsy Oil Co.'s No. 1 Tiger, SE cor. SW NW, Section 3-8-5, in the north extension to the Carr City Pool, in Seminole County, flowed 3,085 bbls. on the gauge of November 10.

The Texas Company's No. 1 Tulsay, NE cor. NW SW, Section 29-9-6, in the southeast extension to the East Earlsboro Pool, flowed 2,275 bbls. on air lift after a 40-quart shot from the Wilcox sand at a total depth of 4,139 feet.

Continental Oil Co.'s No. 1 Walgreen, SE cor. SW, Section 4-7-4, in southern Pottawatomie County, swabbed 30 bbls. in two hours from the Sylvan shale at a total depth of 3,965 feet.

Empire Oil & Refining Co.'s No. 1 Brown, SE cor. NE SE, Section 3-8-5, in the Carr City area, was drilling in

(Continued on Page 230)

RECEIVERS APPOINTED FOR COSDEN OIL CO.

WILMINGTON, Del., Nov. 11.—The Cosden Oil Co. of Fort Worth, Tex., with a refinery in Big Spring, Tex., has been placed in the hands of receivers here. The petition for the receivership was filed by The Texas Corporation and the Reliance Oil & Royalty Co. George N. Moore of Fort Worth, and former Judge Hugh M. Morris, of Wilmington, were appointed receivers.

The Cosden Oil Co. is a complete unit in the oil industry, operating in the Mid-Continent district. The company was formed in 1928 as Cosden & Co., Inc., but the name was changed last year.

The $5,000,000 corporation was organized by Joshua S. Cosden, long a prominent figure in the oil business and its formation represented Mr. Cosden's return to activity in the industry after his loss of control of the old Cosden company, now the Mid-Continent Petroleum Corp., in 1920-21.

SCORE SHEET ON OIL PRODUCTION

Below is shown allotted average daily production in the United States, April to December, inclusive, suggested by the Committee on Economics of the Federal Oil Conservation Board, and the actual daily average production during the week ending November 8:

	Allotted (bbls.)	Actual (bbls.)	Over (bbls.)	Under (bbls.)
California	610,000	600,000	.....	10,000
Oklahoma	655,000	489,050	.....	165,950
Texas	750,000	771,405	21,405	.....
Other fields	480,000	455,426	.....	24,574
Total	2,495,000	2,315,881	21,405	200,524

Net daily average underproduction, 179,119 bbls.

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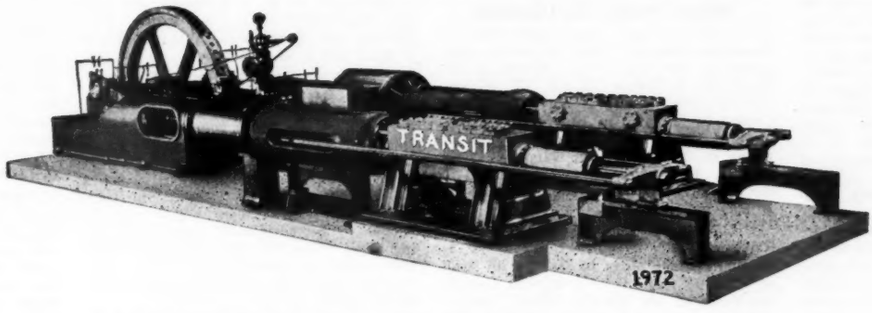

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Woodward, Wight & Co.

SALT LAKE CITY, UTAH
F. C. Richmond Machinery Co.

LOS ANGELES
Republic Supply Company of California

BEAUMONT, TEXAS
E. L. Wilson Hardware Company

PHOENIX, ARIZ.
Pratt-Gilbert Co.

ST. LOUIS, MO.
Reeves & Skinner Machinery Co.

Proration Cuts Deeper in Oklahoma

Production of State Falls to 489,000 Bbls. per Day. Protest From Southern Counties. Several Pool Extensions

By W. A. Spinney
Staff Correspondent, Oklahoma Fields

The effect of proration is reflected by Oklahoma's actual production for the week ending November 8, of approximately 489,000 bbls. a day with the rated potential of the State estimated at 3,200,000 bbls. a day. It is the lowest daily average Oklahoma has had since 1926.

The Champlin Refining Co. has filed a petition with the Oklahoma Corporation Commission, contending the commission has been acting in violation of the constitution in enforcing the curtailment of oil production in the State and asking that the statewide proration order of October 28, setting the producing limits of each field in the State, be vacated, was filed November 1. The petition declares the legislative act under which the proration is enforced is in violation of the fourteenth amendment of the United States Constitution, and it amounts to the taking of property without due compensation.

The hearing of the revision of the statewide proration order as it applies to the southern counties in the State was postponed by the State Corporation Commission Friday, October 31, and will be held within the next 10 days.

Southern Producers Protest

The problem of prorating the small wells in the southern part of Oklahoma in Stephens, Carter, Jefferson, Cotton, Comanche, Garvin, Grady and Marshall Counties, may be adjusted by the Corporation Commission. A meeting of producers was held in Duncan last week and a committee was named to appear before the Oklahoma Corporation Commission to seek a modification of the present order. The committee recommended that the order prorating wells making 5 bbls. of oil a day be applied only to wells not making water and that on leases where wells are making water the proration rule should extend to the entire lease and not to each well. The committee will also ask for five days' time to file petition in the case of leases where wells are making water, that they be exempt from the proration order until a survey can be made. If the protest is decided against the producers, they agree to make up the back proration time. The committee includes H. B. Fell, of Ardmore, chairman; Knox Gravin, Duncan; Sam Emery, of Carter Oil Co.; John Cowden, Duncan; G. L. Pace, Wichita Falls; Cliff Mooern, Wichita Falls; Joe Ray, Chickasha; F. M. Porter, Ardmore; P. Shaner, Duncan. S. T. Urice of Duncan has been appointed umpire of the southern district.

New Well in Tatums

Another producer was added to the Tatums Field during the week, and the edge tests are being watched. The new well was M.G.R. Co.'s No. 2 Mitchell, SE cor. Section 24-1s-3w. It swabbed 817 bbls. the first 24 hours from a series of sands at 2,191-2,375 ft.

The Tatums district in Carter County continues to hold the interest of operators in the southern part of the State. Two producers are expected to be completed in the district in a few days. Magnolia Petroleum Co.'s No. 1 W. H. Hooks, SW cor. Section 13-1s-3w, on the north edge of the pool, has cemented casing at a total depth of 2,133 feet, and will drill into the pay horizon in a few days. Same company's No. 4 J. Pollack, SE cor. Section 14-1s-3w, also in the north part of the field, has cemented casing at 2,241 feet with the total depth 2,252 feet. Trevlyn Oil Co.'s No. 1 Meeks, SE cor. SW SW Section 19-1s-2w, on the southeast edge of the field, is coring a sand at 1,800-30 feet. Magnolia Petroleum Co.'s No. 2 M. Dickerson, SW cor. SE NE Section 24-1s-3w, is waiting for cement to set at 1,933 feet, with the total depth 1,945 feet.

Trevlyn Oil Co.'s No. 1 S. V. Hooks, NW cor. SW SE Section 13-1s-3w, north of production in the field, is a new location, with material moving in.

Southeast of the field Magnolia Petroleum Co.'s No. 1 Harmon, NW cor. SW Section 28-1s-2w, has completed a fishing job and is preparing to resume drilling at a total depth of 4,012 feet. It is located about 2 miles southeast of the Tatums Field.

Wildcat Producer in Comanche

A wildcat test near Comanche in Stephens County finds oil and is estimated at 100 bbls. a day. Harris & McNeill's No. 1 Parker, SE cor. NE SE Section 11-2s-8w, a wildcat northwest of the Comanche Field, in Stephens County, pumped 125 bbls. of oil and 125 bbls. of water in 24 hours, from sand at 2,049-53 feet. Large tubing is being landed in the hole in an effort to exhaust the water. It may be plugged back a few feet.

Dixie Oil Co. and others' No. 1 Pitts, SW cor. NE NW SE Section 3-2s-8w, is drilling cement plugs to test an oil sand at 1,503-08 feet. It is a wildcat located southeast of the Empire Field. Turner and others' No. 1 Andrews, NW cor. SW SW Section 5-2s-7w, a wildcat, is shut down after cementing surface pipe.

W. O. Smythe and others' No. 1 House, SE cor. SW NW Section 29-2-8w, Stephens County, a wildcat northwest of production, was drilling deeper after testing a sand at 2,464-69 feet with salt water.

In the Cement district in Caddo County several tests are nearing the deep sand horizon. Magnolia Petroleum Co.'s No. 4 Medrano, NE cor. SW Section 36-6-10w, on the west side of the producing area, has cemented casing at 3,253 feet, after coring a showing of oil in sand at 3,260-86 feet. Same company's No. 1 White, SW cor. SE Section 25-6-10w, was drilling at 4,528 feet. It is the deepest drilling test in the pool. Magnolia Petroleum Co.'s No. 8 Lindsey, NE cor. NW SE Section 36-6-10w, was drilling in sandy lime at 3,392 feet.

Extension in Oklahoma City

Production was extended to the north in the Oklahoma City Pool during the week when Jones Brothers Drilling Co. and others' No. 1 Scruggs, in approximately SE cor. NE SE, Section 35-12-3w, was brought onto production. The well extends the producing area almost a half mile north. The fluid was bailed down about 1,500 feet and the flow turned into the pits before it was shut in to erect a new separator. A production test will be made later. The well is estimated to be a 5,000-bbl. oil well and 100,000,000 feet of gas a day. Production was found in the Wilcox sand at a total depth of 6,398 feet. It is also located near the residential section of the city.

During the week ending November 8, only six wells were completed in the Oklahoma City Field. The early part of the week the field operations were shut down because of the Morgan Royalty Co.'s wild well. This delayed the completion of several tests which are expected to be completed early the coming week. Ten new locations were made and announced for the same seven days, most of them being in the northwest part of the field.

The total production of the Oklahoma City Field for the week ending November 8, was approximately 465,175 bbls. which is a considerable decrease from the previous week. A large number of the wells completed in the field are underproduced. The southern part of the field is apparently drilled up, only five tests are drilling in that part of the pool.

Hall & Briscoe's No. 5 Holmes, NW cor. SE, Section 10-11-3w, which is one of the largest wells completed in the Oklahoma City Pool, was opened Sunday, November 9, and made 7,685 bbls. in 2 hours and 30 minutes, and was then shut in filling the storage. It has flowed a total of 55,820 bbls. in 16 hours and 20 minutes since completed.

Mid-Kansas Oil & Gas Co.'s No. 1 Ball, NW cor. NE, Section 19-12-1w, offsetting the discovery well in the Nicoma Park area, in Oklahoma County, several miles east of the Oklahoma City Pool, was drilling the cement plug to make a production of the sand at 6,163-66 feet. The sand was showing oil and it is believed the well will be a larger producer than the discovery well, which has been averaging around 185 bbls. a day from sand at total depth of 6,250 feet.

Wildcatting Logan County

The western part of Logan County is expected to get an oil play when conditions warrant, as the result of the recent finding of oil in the wildcat well of the Eason Oil Co. on the Katschor 400-acre lease southwest of Cresent in Section 34-17-4w. The well was completed about four weeks ago with an initial production of 650 bbls. and has since been making around 400 bbls. a day. It extended production a considerable distance to the west and if conditions in the oil industry had been normal an active drilling would have immediately started.

The Eason Oil Co. has a refinery in Enid and is handling its own oil. The oil was found in the Layton sand at 4,919-42 feet. The well is located about 15 miles south of the Roxana Pool, in Logan County, which was opened about three years ago, yielding wells with an initial production of 5,000 bbls. a day from a total depth of 6,000 feet, which was the deepest production in the State at that time. The Shell Petroleum Corp.'s discovery well on the McCully land, is believed to be the first deep sand producer in the State and many express the opinion it led to the drilling of the deep test in the Oklahoma City area. The discovery well in the Roxana Field, is still producing 400 bbls. a day having an initial of 5,000 bbls. a day. About 100 tests were drilled in the vicinity as the result of the discovery well, giving the field a flush production of 25,000 bbls. a day. The flush production has declined and many of the wells are on the pump and no new work is underway. With the completion of the Eason Oil Co.'s well leasing and royalty activities has been greatly stimulated.

Another wildcat test which is showing oil and is believed to be second in importance, is the Prairie Oil & Gas Co. and others' No. 1 Wright, C NW SW, Section 23-15-5w, Kingfisher County, located about 18 miles southwest of the Eason Oil Co.'s wildcat well. The oil showing was found at 6,145 feet.

The Eason Oil Co.'s well has been prorated to 100 bbls. a day under the proration orders.

Prairie Oil & Gas Co.'s No. 1 Elrod, NE cor. NW SW, Section 31-19-4w, in the Roxana-Marshall area of Logan County, is making 70 bbls. a day from a total depth of 6,000 feet. The oil is coming from 5,658-75 feet. The company is attempting to drill by lost tools to drill the well deeper. It is also making a little water, which is believed to be coming from the shallow formations.

In the new Wilcox sand area south of Wewoka, in eastern Seminole County, Mid-Kansas Oil & Gas Co. has acquired a half interest from the Ramsey Petroleum Corp. in 352 acres. The transaction carried no cash consideration but the Mid-Kansas Oil & Gas Co. will drill a well, carrying the Ramsey Petroleum Corp.'s half interest. The acreage involved in N half NW Section 30-8-8, N half S half NW Section 30-8-8, SE SW Section 18-8-8, SW of NW Section 19-8-8. The property has three producing wells in the shallow sands making around 10 bbls. a day. The Ramsey Petroleum Corp. has started two more tests on one of the leases to

(Continued on Page 206)

WILDCAT OPERATIONS IN OKLAHOMA

(Descriptions are East and North unless marked otherwise)

NORTHERN OKLAHOMA

ALFALFA COUNTY

Company, farm and location—	Remarks:
Smith Brothers' No. 1 Forbes, SE cor. NW NW Sec. 12-27-11w	Shut down 1,232 ft.
J. W. Bailey's No. 1 Acre, SW cor. NE Sec. 14-24-11w	Rigging up standard tools 4,660 ft. shut down.

BECKHAM COUNTY

Price-McFann's No. 1 Webster, C SW SW Sec. 34-8-26w	Drlg. 765 ft.
Mid-Continent's No. 1 Schaff, C NE SW Sec. 22-11-22w	Waiting on cement to set 430 ft.
Producers Exploration Co.'s No. 1 Sidell, SE cor. SW SW Sec. 17-2-22w	Shut down 2,402 ft.
Carson et al's No. 1 Danby, SW cor. SE NE Sec. 20-8-22w	Shut down 1,606 ft.
White et al's No. 1 Green, SW cor. Sec. 34-10-24w	Shut down 1,320 ft.

BLAINE COUNTY

Washoma Oil Co. et al's No. 1 Phillips, C NW SW Sec. 13-19-10w	Drlg. 4,155 ft.

CADDO COUNTY

Abernathy & Brown's No. 2 Houston, Sec. 24-6-11w	Shut down 1,090 ft.
Simms Pet. Co.'s No. 1 Cobsa, SW NW Sec. 24-6-11w	Drlg. 3,436 ft.

CLEVELAND COUNTY

Harris et al's No. 1 Highbee, SE NW Sec. 20-6-1	Shut down 6,518 ft.

COAL COUNTY

Whitney et al's No. 1 Miller, SE NE Sec. 10-2-8	Rig.
Mid Western Oil Co.'s No. 1 Gum Bros., C SW NW Sec. 30-3-10	Spudding.
A. M. Van Orden's No. 1 Jamison, SE SW Sec. 31-1-9	Shut down 1,668 ft.
Blackwell O. & G. Co.'s No. 1 L. Jackson, NW cor. Sec. 25-3-9	Drlg. 4,575 ft.
W. E. McGraw's No. 1 King, C SW NE Sec. 11-1-8e	Shut down 3,030 ft.

COMANCHE COUNTY

Croy & Young's No. 1 Cline, NW NE NE Sec. 8-3-10w	Drlg. 1,010 ft.
G. W. Stogner's No. 1 Doebel, C SW SW Sec. 3-3-9w	Shut down 1,450 ft.

GARFIELD COUNTY

E. L. Love et al's No. 1 White, SE cor. NW Sec. 9-24-6w	Drlg. 5,770 ft.

GRADY COUNTY

J. V. Bailey's No. 1 Hubbard, C NE NW Sec. 1-10-6w	Shut down 100 ft.

GRANT COUNTY

Bu-Vi-Bar and Amerada's No. 1 Hurst, C SW Sec. 25-26-5w	Fishing 5,864 ft.

GREER COUNTY

French's No. 1 Murphy, SW NW SE Sec. 23-7-21w	Shut down 500 ft.

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Prairie Will Prorate Kansas Fields

Applies Oklahoma Method in Older Fields. New Wells in Eastborough Increase State's Total Production

By W. A. Spinney
Staff Correspondent, Kansas Fields

The production of Kansas for the week ending November 8 was approximately 117,300 bbls. daily, which is an increase of around 3,000 bbls. a day over the preceding week. The increase is believed to be mostly in the Eastborough Pool, in Sedgwick County, where new producers are being completed with large potential production.

Prairie Oil & Gas Co. on November 7 announced a reduction in its purchases of crude oil in Kansas. Other pipe line companies purchasing oil in the State have not as yet made any change in the amount of oil they are purchasing, in the older areas.

The Prairie Oil & Gas Co. announced that effective November 10, and until further notice, it will adopt the Oklahoma plan of proration for its general purchases of oil in the State of Kansas. In all Kansas areas where it is buying oil, excepting the Voshell Pool and Ritz area in McPherson County; Wright area in Sedgwick County; and Schurr-Raymond Pools in Rice County, which have been under specific proration, the Prairie Oil & Gas Co. will purchase oil on the marginal basis of 5 bbls. per well per lease and 50 per cent of the remainder. For example, if a lease from which it is purchasing oil has a normal production of 100 bbls. a day from four wells, it will purchase 60 bbls. a day, of which 20 bbls. represents the marginal of 5 bbls. per well and 40 bbls. represents 50 per cent of the remainder. The Prairie Oil & Gas Co. says it will make no exceptions in favor of its own leases but that it is prorating its production on the same marginal basis. In the present prorated pools, the Prairie Oil & Gas Co. purchases in the Voshell Pool are reduced from 2,300 bbls. to 1,200 bbls. daily, and the Ritz Pool from 1,968 bbls. to 1,000 bbls. a day. The Schurr-Raymond area until further notice 550 bbls. daily. No change is announced in the percentage basis in the Wright Pool.

Many Wells of Over 5 Bbls.

Outside of the old shallow fields of eastern Kansas there is no county in the State in which the average production per well does not exceed 5 bbls. per day. If the action of the Prairie Oil & Gas Co. were to be generally followed by purchasing companies it would make a very considerable cut in the production of Kansas. The following table shows the production as of September, the number of wells in each county as of September 30, and the average production per well per day:

County—	Oil wells	Av.dy. prod. (bbls.)	Av.dy. prod. per well (bbls.)
Marion	221	3,512	15.89
Butler	3,284	24,775	7.54
Greenwood	2,847	20,400	7.16
Cowley	440	5,821	13.22
Sumner	204	9.091	44.55
Sedgwick	173	18,022	104.52
West half Elk	265	1,477	5.57
Harvey	3	123	41.00
Russell	164	3,693	22.51
Reno	2	40	20.00
Rooks	2	55	27.50
Trego	1	17	17.00
McPherson	113	14.829	131.23
All others	12,542	11,662	.93
Total	20,261	113,517	5.60

In the Sedgwick Pools

Magnolia Petroleum Co.'s No. 2 Wheeler, NE cor., Section 19-27-2, Eastborough Pool, in Sedgwick County, is the twenty-eighth well completed in the pool on the east edge of Wichita. The well swabbed 30 bbls. an hour from chat at 2,928-62 feet.

Another well was completed in the Eastborough Pool, in Sedgwick County, and extends production to the northwest. Work & Covell's No. 1 Freeman, NE cor. NW, Section 19-27-2, found oil in the chat at 2,997-3,000 feet. Oil rose 350 feet in the hole in 15 minutes. The hole was caving and it was necessary to land the 6-inch casing before a swabbing test can be made. It will be several days before a production test can be made. The well is believed to be structurally lower than wells to the east. The south offset is owned by the Continental Oil Co. and it will be necessary for that company to start two tests, the first entry the company has made into the Eastborough Pool.

The recent completion of E. B. Shawver and others in the SE cor. SW SE, Section 18-27-2, will cause the Derby Oil Co. to drill another test offsetting it to the south on the Eastborough estates property. E. B. Shawver is expected to start several more tests along the south line of the lease to protect the property from drainage.

Production on the east side of the Eastborough Pool was defined by the Derby Oil Co.'s No. 2 Rimel, NE cor., Section 3-27-2, which found water in the Simpson sand at 3,415-20 feet, and is preparing to abandon. Fisher & Lauck's No. 7 Trustee, SE cor., Section 19-27-2, is pulling the big pipe to abandon after finding a hole full of water in the deep sand horizon at 3,280-83 feet.

Eastborough Production

The production from some of the older wells in the Eastborough Pool in 24 hours was as follows: National Refining Co.'s Nos. 1 and 2 Murdock, in Section 18-27-2, 2,109 bbls.; Derby Oil Co.'s Nos. 1, 2, 3 and 4 Eastborough in Section 19-27-2, 1,971 bbls.; same company's No. 1 Rimel, 782 bbls.; same company's No. 1 Cloud, in Section 19-27-2, 226 bbls., and No. 1-A Eastborough estate, 71 bbls. Fisher & Lauck's seven wells on Trustee lease in Section 19-27-2, made 2,169 bbls. in 31 hours. Same operators' No. 1 Schaffer, in Section 30-27-2, made 152 bbls.; Blankinship Petroleum Co.'s two wells in Section 30-27-2, approximately 500 bbls.; Vickers Petroleum Corp. and others' Keys lease in Section 30-27-2, around 2,500 bbls.

Wildcat Test in Rush County

A wildcat block of acreage in Rush County will be tested with the announcement of Dewey & Mitchell's No. 1 C SW, Section 17-19-16w, which is a location. It will be a Silicious lime test and is expected to be drilled to 4,000 feet, unless oil or gas is found in shallower formations. The test will be on a 6,000-acre block, on which close-in acreage has been acquired by several major oil companies. The test is believed to be located on the granite ridge which runs in a southwest and northeast direction through the area.

Another Rush County wildcat test drilled to granite and will be abandoned. Prairie Oil & Gas Co. and others' No. 1 Leiker, in Section 5-16-18w, has the granite at 3,743 feet and will be plugged at that depth.

Sinclair Oil & Gas Co. has purchased the 15-car loading rack at Elryia, in McPherson County, southeast of the Voshell Pool, and the 4-inch pipe line from the Voshell Pool to the loading rack, formerly owned and operated by Skelly Oil Co. The loading rack was discontinued with the building of a pipe into the Voshell Pool. It is believed the Sinclair Oil & Gas Co. will immediately start running 2,500 bbls. a day of its own crude from the Voshell Pool to its refinery at Coffeyville, Kans., via tank car shipments. The Sinclair Oil & Gas Co. is a large producer in the Voshell Pool, and has an allowable production of about 2,500 bbls a day from its two leases, the Voshell and Moorehouse. It does not buy any oil in the pool.

Pipe Line to Schurr Pool

Activity is expected to increase in the Schurr Pool, in Rice County with the completion of a pipe line into the area and with the report of the largest well completed in the area. The new well is Slick, Pryor & Lockhart's No. 2 Schurr, NE cor. NW SW, Section 21-20-10w. It swabbed 137 bbls. the first hour and 140 bbls. the second hour, and never lowering the oil in the hole over 700 feet from the top. The oil was found in the Silicious lime at 3,307-40 feet. It is called a 3,000-bbl. well. It extends production to the southwest.

Prairie Building a Pipe Line

The 8-inch pipe line which the Prairie Pipe Line Co. is building between the Voshell Pool, and the Schurr Pool, in Rice County, is completed for a distance of about 18 miles. The entire line is expected to be about 40 miles in length. It will be the first pipe line into the area. The Prairie Pipe Line Co. expects to complete the line by the first of the year. The pool is without an outlet and has been since the Independent Oil & Gas Co. discontinued its loading rack several months ago. It was loading about 250 bbls. a day in tank car shipments from the area.

Activity in Lyon County continues with the announcement of a new location, Bird, Hanley & Sheedy's No. 1, SE cor. NW, Section 30-20-10, Lyon County. The new location is west of the Phillips Petroleum Co.'s No. 1 Darr, in Section 29-20-10, which found a showing of oil and was drilling deeper at 2,400 feet. A short time ago the Aladdin Petroleum Corp.'s No. 1 Meffert, in Section 29-20-10, a nearby test, also found a showing of oil in the Bartlesville sand, but it was completed as a failure. This part of the county is now receiving considerable attention.

Empire Oil & Refining Co. has announced a new location in the northern part of Greenwood County. The location is No. 1 Braddock, SE cor. NW, Section 23-22-12. It is the only operation the company has in the county. The company also has numerous untested locations on its Patterson Pool acreage in the same area.

Extension in Russell County

In southern Russell County, another extension to the producing area, was in prospect. The Signal Oil Co.'s No. 1 Sellens, SE cor. NW, Section 26-15-13w, filled up 600 feet with oil from the conglomerate at 3,233-49 feet in less than an hour. The well is about a mile northwest of the Sellens Pool, where three wells are making around 300 bbls. a day pumping on a daylight schedule under a proration agreement. The new well was later given a swabbing test and made 251 bbls. in 12 hours, and was shut in for storage.

Lost Springs Extended

Another extension to the Lost Springs Pool, in northern Marion County, was opened during the week by the R. E. Yonker's No. 1 Riffel, NW cor. SW SW, Section 11-17-4. It swabbed 10 bbls. an hour from the chat at 2,320-71 feet. The well extends production a quarter mile north of other production and it is being put on the pump. Same operator is preparing to drill another test, No. 1 Riffel, SE cor., Section 10-17-4, a quarter mile south and a location west of the new well. Other tests starting in the area were J. W. Harwood's No. 1 Cowman, NE cor. SW, Section 11-17-4, a quarter mile north of the new well. Stearns-Streeter Co.'s No. 1, in NE cor., Section 15-17-4, is also preparing to start, offsetting a 110-bbl. well in NW cor., Section 14-17-4. The recent completions and the starting of the three new tests in the area makes the area more active than it has been in several months. Other leaseowners in the vicinity are T. C. Johnson and Phillips Petroleum Co.

Danciger Oil & Refining Co.'s No. 1 in the SW cor., Section 3-2-35w, Rawlins County, found a showing of gas in shale at 1,575 feet, and is drilling at

(Continued on Page 206)

WILDCAT OPERATIONS IN KANSAS

(Descriptions are East unless marked otherwise)

BARTON COUNTY

Company, farm and location— Remarks:
Skelton Oil Co.'s No. 1 Ott, C SE SE Sec. 16-19-14w.....Shut down 50 ft.
McCool et al's No. 1 Tsern, NW SE NE Sec. 12-20-11w..Shut down 1,600 ft.

BUTLER COUNTY

McCulloch and Empire's No. 1 Lilley, SW NW NW Sec. 23-23-5.....Drlg. 2,175 ft.
Farrell et al's No. 1 Sutton, NW cor. Sec. 18-28-7.....Drlg. 1,100 ft.

CLARK COUNTY

Watchorn's No. 2 Morrison, NW NE Sec. 20-32-21w.....Fishing 6,909 ft.

CLAY COUNTY

Crystal Oil et al's No. 1 Tivier, SW cor. Sec. 19-8-2 .....Drlg. 2,390 ft.

COFFEY COUNTY

Heyburg's No. 1 Kroft, SE SW SE Sec. 30-22-14.....Drlg. 818 ft.
McGregor's No. 1 Wood, NE NW SW Sec. 20-22-15.....Shut down 650 ft.
Roberts et al's No. 1 Hay, SW SE NW Sec. 32-22-15.....Shut down 1,125 ft.

COWLEY COUNTY

Roth & Farout's No. 1 Reedy, SW NW NE Sec. 8-32-8...Fishing 912 ft.
Tom Fine's No. 1 Boyd, NW NE Sec. 32-32-4.....Shut down 2,650 ft.

DICKINSON COUNTY

Severs et al's No. 1 Lavengood, NE SW Sec. 13-13-2.....Shut down 2,775 ft.

DOUGLAS COUNTY

Steinbuckle's No. 1 Unknown, SW NE NW Sec. 34-14-21.Shut down 1,100 ft.

ELLIS COUNTY

Central Commercial Oil Co.'s No. 1 Helms, SE cor. NE Sec. 2-12-20w.....Fishing 3,916 ft.

ELK COUNTY

Aladdin's No. 1 Donnell, NE SE SW Sec. 26-29-10.....Wilcox 2,386-2,411 ft.; show oil; shut down.

ELLSWORTH COUNTY

Aladdin Pet's No. 1 Stoddenberg, C SW Sec. 22-16-10w...Rig on ground.
Milton et al's No. 1 Kester, SE NE Sec. 6-14-9w.....Shut down 820 ft.
Aladdin and Carter Oil Co.'s No. 1 Barecky, C NW Sec. 3-16-10w .....Drlg. 2,000 ft.
Slick et al's No. 1 Hecken, NW cor. Sec. 25-17-10w.....8,000,000 ft. gas 2,980-91 ft.; 3,331-43 ft. 68 bbls. 1 hr., 147 bbls. 2 hrs.; well is shut in.

FORD COUNTY

Swain et al's No. 1 Taylor, C NW Sec. 21-25-24w.....Drlg. 4,300 ft.

GOVE COUNTY

Johnson and Atlantic's No. 1 Wright, SE NE Sec. 11-12-27w .....Drlg. 2,165 ft.
Valerius & Baucher Oil Co.'s No. 1 Todd, NW cor. Sec. 24-13-27w ..... Drlg. 4,460-66 ft.; show water; fishing.

(Continued on Page 242)

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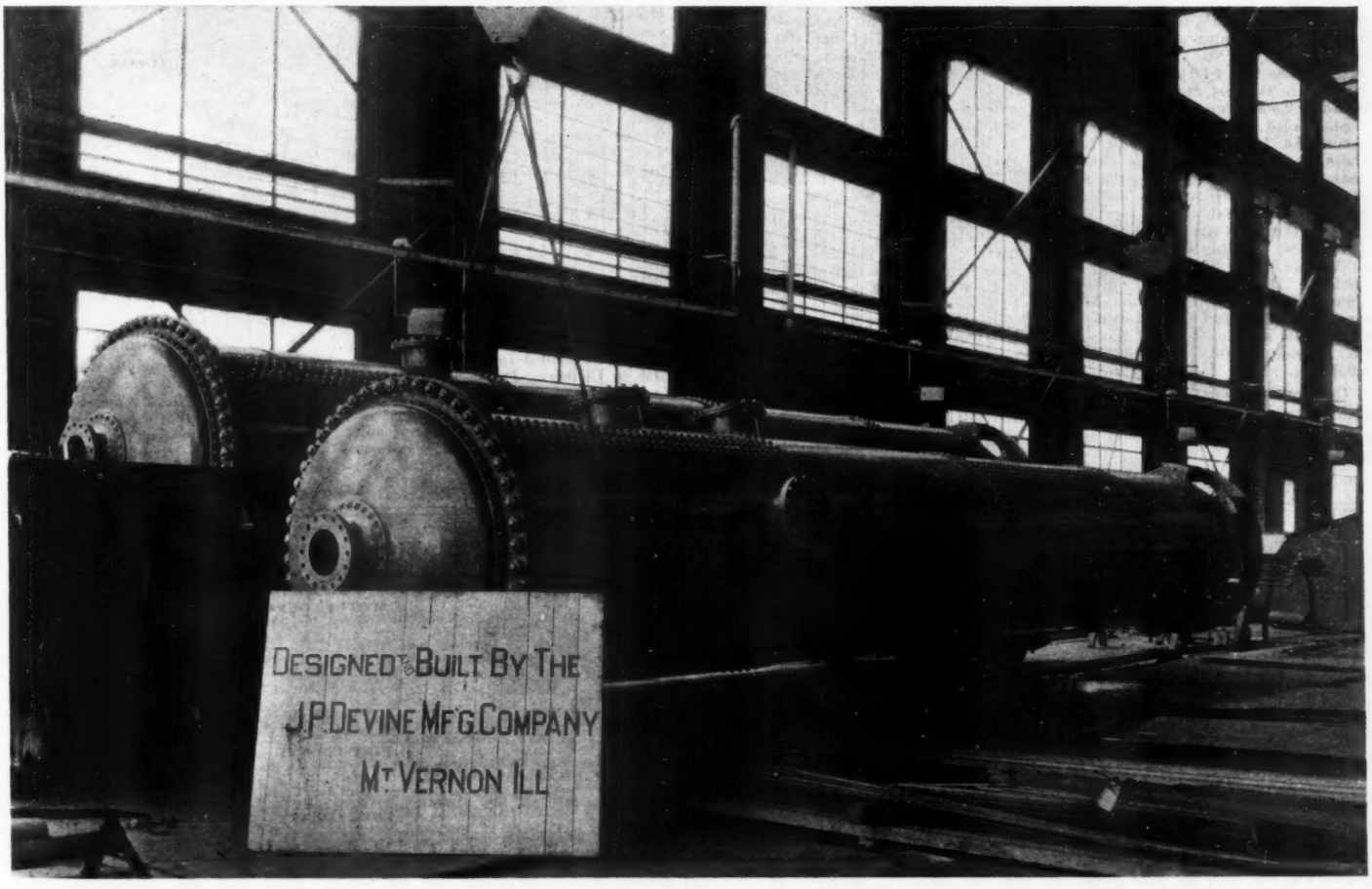

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Five Dry Holes in the Zwolle District

Some of These Offset Producing Wells. Holly District Furnishes Surprise Well. Lion Buys More Arkansas Properties

By D. H. Bancroft
Staff Correspondent, Louisiana-Arkansas

SHREVEPORT, La. Nov. 10. — Dry holes in the east and north extensions of Zwolle, offsetting producers in some cases and previous failures in others, were true to Zwolle form. There were five such completed during the week and two producers. The latter were R. L. Gay's No. 1 Peterson, a Zwolle Townsite well in Section 31-8-12 flowing 100 bbls. from the marl at 2,400 feet, and Pelican Natural Gas Co.'s No. 5 Sabine Lumber Co., NW NE, Section 11-7-12, two locations west of No. 4, the two of them being 1½ miles south of the nearest production in the discovery section, made 300 bbls. initial from the marl at 2,346 feet. Dixie Oil Co.'s No. 1 Parrott, SE NE, Section 26-8-12, half way between production in that section and Section 25, the nearest wells being a quarter mile away, was abandoned as a dry hole at 2,650 feet. It topped Zwolle chalk at 2,364 feet and set 6⅝-inch casing but had no show of anything all the way down. Loring Oil Co.'s No. 1 Garner, SW cor. NW NE, Section 4-7-11, the farthest east location in the east extension, was abandoned at 2,550 when a show of oil at that depth bailed dry, and C. D. Neff and others' No. 1-A Turner, NE cor. NW of the same section, a half mile west, was abandoned at 2,600 feet. In the Zwolle discovery area Loring Oil Co. decided not to pump No. 2 Sabine Lumber Co., SE NE, Section 34-8-12, and abandoned it. It had been standing with 100 feet of oil in the hole for the last two months. Pugh-Hickman Drilling Co.'s No. 1 Sabine Lumber Co., NW NE, Section 34-8-12, was dry at 2,650 feet and abandoned. A. C. Glassell abandoned No. 1 Logan Oil Co., Section 23-10-13, Pleasant Hill, at 1,958 feet.

The Loring Sabine well was a case in point of the effect operators think the recent cut in crude prices will have on this territory, that is, to take many small pumpers off production, as the present prices will in some cases barely pay lifting costs.

Surprise in Holly District

The Holly district of DeSoto Parish surprised the fraternity by yielding the Standard Oil Co. a 600-bbl. well, No. 4-A Farmer, an edge well on the north in the NW cor. NE NW, Section 5-13-13, total depth 2,898 feet.

Toteco Oil Corp.'s No. 1 Louisiana Long Leaf Lumber Co., NE NW Section 18-6-12, a wildcat 9 miles south of Zwolle, got salt water and is abandoned at 4,077 feet. It was a workover, having been abandoned as a junked hole at the same depth after it blew out from around 2,500 feet. Six and five-eighths was cemented 10 days ago and early this week plug was drilled and the hole reamed 10 feet below the seat, at 2,984 feet. In bailing down the hole was found bridged far up the casing and after getting this out of the way bailing was continued. The well started flowing hot salt water at the rate of about 20,000 bbls. a day with no signs of oil and just enough gas to help it flow.

Lide and others' No. 1 Ponder, SE NW, Section 15-7-11, had 100 feet of oil in the hole at 2,422 feet, drilled to 2,601 feet, tested dry, and is awaiting orders. It is a wildcat 2 miles south of the east extension producers. Loring Oil Co.'s No. 1 Middleton, a quarter mile southeast of Dixie Oil Co.'s dry No. 1 Parrott, in Section 26-8-12, was dry in the marl at 2,388 feet and again at 2,650 feet and probably will be abandoned.

Arkansas-Louisiana Pipe Line Co. ran testing tool on No. 3 Johnson, Section 1-11-14, DeSoto Parish, at 2,794-2,806 feet, got no results, and is coring at 2,820 feet. After testing dry on an oil show in 12 feet of sand at 2,933 feet, J. W. Clark drilled No. 1 Tidwell, Section 22-13-14, to 2,950 feet and again tested dry on a small show of oil and gas and shut down for orders. Aakes and others are making up a 5,000-acre block around Section 20-13-15 for a 3,000-foot hole.

Over in central east Louisiana Stovall Drilling Co.'s No. 1 Miller, NE SW, Section 18-10-10, Tensas Parish, is a gas well. It is good for 19,000 feet of gas at 125 pounds pressure from 712 feet, old total depth 1,560 feet, after plugging back to test a show encountered during the original drilling. It is about the first well in Tensas Parish that has been finished as a commercial well, being classed as such because it will probably furnish fuel to one if not both of the two other wildcats drilling in the vicinity. A. C. Glassell abandoned location for No. 1 Pecania plantation in Section 46-8-9, Concordia Parish. In Avoyelles Parish where two wells are drilling close to Marksville, Hope Oil & Gas Co. has taken a block of 7,000 acres in Township 2, Ranges 4 and 5, south of that town, but what the plans for developing it are have not been reported here.

Trinity Tests Abandoned

Two wells slated for Trinity tests in the Bellevue district of Bossier Parish were abandoned, Louisiana Oil Refining Corp.'s No. 13-B Bodcaw, SE SW, Section 11-19-11, in the old Bellevue Pool, junked at 1,960 feet, and Autrey Oil Co.'s No. 1 Johnson, SW NW, Section 34-19-11, at 60 feet. The same company has made location for No. 14-B Bodcaw 50 feet west of the abandoned test. Andrews & Davlin's wildcat, No. 1 Nattin, Section 15-22-14, tested salt water at 1,546 feet and is shut down. The Texas Company cored 14 feet of sand in No. 1 Pine Woods, Section 25-23-12, Carterville district, Bossier Parish, set 4½-inch at 3,130 feet and is arranging to test, total depth 3,149 feet.

The only thing that happened in Caddo Parish was Bayou State Oil Corp.'s No. 4 Barr, SE SW, Section 30-22-15, Hosston district, a 40-bbl. pumper at 1,072 feet, the same company getting rig up for No 5 on the same lease.

Deep Test Locations

Locations for two of the three deep tests to be drilled in the immediate future in Claiborne Parish were made by Louisiana Oil Refining Corp. in the Homer proven area and by Prairie Oil & Gas Co. on the Slick block several miles northeast of Homer. The Louisiana company's location is No. 10 on the Langston farm, SW SW, Section 19-21-7, and is to be a 4,500-foot test. The Prairie location is on the Shackelford land, SE NE, Section 30-23-5, and is to go 5,000 feet if necessary. Both have derricks up. A second location by the Prairie Oil & Gas Co. probably will be in Section 13-23-5. Triangle Drilling Co. has drill stem stuck at 4,049 feet on No. 1 Brownfield, Section 6-19-5, Sugar Creek district, and cemented 9-inch at 4,060 feet on No. 1 Stevenson in the same section. All other Claiborne wells remain idle.

Average daily production week ending November 8:

NORTH LOUISIANA	
Caddo, light	8,385
Caddo, heavy	2,715
Homer	3,360
Haynesville	5,250
DeSoto-Red River	2,910
Elm Grove	545
Bellevue	630
Cotton Valley	1,850
Urania	5,360
Pleasant Hill	495
Sarepta-Carterville	2,475
Zwolle	8,685
Holly	1,220
Total North Louisiana	43,880
Last week	42,905
Increase	975
ARKANSAS	
El Dorado	3,925
Smackover, light	4,875
Smackover, heavy	35,785
Stephens	880
Nevada County	1,025
Lisbon	900
Champagnolle	3,430
Bradley	65
Mount Holly	75
Urbana	1,110
Total Arkansas	52,070
Last week	53,050
Decrease	980
Both states	95,950
Last week	95,955
Decrease	5

Monroe-Richland

Three wells were completed in the Monroe-Richland gas area: Ouachita Natural Gas Co.'s No. 2 Cole, Section 13-20-4, Morehouse Parish, gauged 1,980,000 feet of gas at 290 pounds pressure, total depth 2,183 feet. Grecian Bend Gas Co. abandoned location for No. 1 Sandidge

(Continued on Page 206)

LOUISIANA-ARKANSAS PROVEN AREAS

(Rotary operations unless otherwise designated.)

SABINE PARISH—ZWOLLE

W. M. Coates' No. 1 Sabine Lbr. Co., 424 ft. N, 424 ft. E, SW cor. NW SW, Sec. 1-7-12 — Began drlg. Oct. 31; cmtd. 10-in. 103 ft; drlg. 400 ft.

Tom Davis' No. 1 Holliday (was T. D. Allison's), Sec. 31-8-13, Zwolle Townsite — S.D. wtr. 1,350 ft.

F. M. Hood's No. 1-B Winston (was No. 2), 700 ft. E, 425 ft. S, NW cor., Sec. 31-8-12, Zwolle Townsite — S.D. 1,065 ft.

Ab Jones et al's No. 1 Ferguson, 330 ft. N, 330 ft. W, SE cor. NE SW, Sec. 33-8-12 — Rig up.

Lacey Burkett Co.'s No. 1 Danna, 316 ft. E, 200 ft. S, C, Sec. 26-8-12 — W.O.S.R; full oil; T.D. 2,404 ft.

Loring Oil Co.'s No. 1 Middleton, 200 ft. E, 200 ft. S, NW cor. NE SE, Sec. 26-8-12 — D.S. test 2,388 ft; dry; W.O. 2,650 ft.

Loring Oil Co.'s No. 2 Middleton, 330 ft. W, 175 ft. S, NE cor. NE SE, Sec. 26-8-12 — Cmtd. 6⅝-in. 2,332 ft.

Lyon et al's No. 1 Neely (was No. 1 Williams), 330 ft. N, 330 ft. W, SE cor. SW SE, Sec. 33-8-11 — Dry 2,300 ft. and 2,440 ft; whipstocked csg. 2,024 ft; S.D. 2,261 ft.

Pelican Nat. Gas Co.'s No. 6 La. Long Leaf Lbr. Co., 200 ft. N, 200 ft. W, SE cor. NW SW, Sec. 4-7-11 — Derrick.

H. W. Perritt, trustee's No. 1 Bowman-Hicks, 330 ft. N, 330 ft. W, SE cor. SW, Sec. 2-7-12 — Drlg. 1,400 ft.

Standard Oil Co.'s No. 1 Bowman-Hicks, 330 ft. N, 330 ft. E, SW cor. SW NW, Sec. 25-8-12 — Top marl 2,306 ft; cmtd. 6⅝-in. 2,368 ft.

Tarver et al's No. 4 Sabine State Bank, 220 ft. W, 270 ft. N, C, Sec. 26-8-12 — Cmtd. 6⅝-in. 2,324 ft; tested dry 2,482 ft; W.O.

C. H. Teat et al's No. 1 Craig, 300 ft. N, 300 ft. E, SW cor. NE NE, Sec. 25-8-12 — Bailing to test 2,450 ft.

Wheatcroft et al's No. 1 Sabine Lbr. Co., SW NE, Sec. 31-8-12 — S.D. 2,495 ft.

SABINE PARISH—BLUE LAKE

R. L. Gay's No. 8 Bowman-Hicks, Sec. 18-7-13 — Recmtd. back to 2,392 ft; old T.D. 2,552 ft.

R. L. Gay's No. 9 Bowman-Hicks, 330 ft. N, 330 ft. W, SE cor. NE SW, Sec. 18-7-13 — Drlg. 1,909 ft.

(Continued on Page 190)

WILDCAT OPERATIONS IN LOUISIANA-ARKANSAS

(Rotary operations unless otherwise designated.)

OUACHITA COUNTY

Belmont et al's No. 1 Buck, SE cor. SE SW, Sec. 16-15-17 — Fishing drill bit and collar; T.D. 2,907 ft.

Copenhaven et al's No. 1 Elliott, Sec. 11-15-17 — Drlg. 926 ft.

Graves Bros.' No. 1 Walker, 350 ft. N, 280 ft. E, SW cor., Sec. 9-14-18 — Small S.O. 1,861 ft; tested dry; cored sandy shale 1,861-73 ft; W.O.S.R. 1,873 ft.

A. B. Turner, trustee's No. 1 Dave Brown, 220 ft. N, 220 ft. E, SW cor., Sec. 23-15-18 — Junked and abd; skidded 55 ft. E; drlg. second hole, 55 ft.

PIKE COUNTY

E. R. Henderson's No. 1 Tilyou, 660 ft. W, 500 ft. S, NE cor. NE SE, Sec. 26-8-14 — Drlg. 1,270 ft.

E. R. Henderson's No. 1 J. L. Lee, 400 ft. S, 350 ft. E, NW cor. SW SE, Sec. 31-8-24 — Location.

POPE COUNTY

Ark.-La. P. L. Co.'s No. 2 McFaddin, 685 ft. N, 485 ft. W, SE cor. NE SW, Sec. 15-9-21 — Drlg. 1,995 ft.

SCOTT COUNTY

Ark. Valley Gas Co.'s No. 1 Turner, C SE, Sec. 27-5-30 — Location.

Heavener O. & G. Co.'s No. 1 Riser, Sec. 36-4-26 — Hole clean; fishing 1,535 ft.

SEBASTIAN COUNTY

Lavaca O. & G. Co.'s No. 1 Davis, C NW NE, Sec. 29-8-30 — Drlg. shale 1,400 ft.

UNION COUNTY

S. B. Hickman's No. 1 Hogg, 330 ft. S, 150 ft. E, NW cor. SE SE, Sec. 35-16-17 — S.D. 2,575 ft.

H. L. Hunt's No. 1 Swilly, 330 ft. S, 330 ft. W, NE cor., Sec. 28-16-16 — W.O.S.R; 2,000 ft. fluid; T.D. 2,689 ft.

H. L. Hunt's No. 6 Swilly, 330 ft. N, 330 ft. W, SE cor., Sec. 21-16-16 — Location.

H. L. Hunt's No. 1 Trammell, 240 ft. S, 330 ft. E, NW cor. SW NW, Sec. 28-18-12 — O.W.D.D; dry and abd. 2,886 ft; coring 4,052 ft.

Marine Oil Co.'s No. 5-A Thompson, 330 ft. S, 330 ft. W, NE cor. SW NE, Sec. 10-18-13 — Began drlg. Nov. 1; cmtd. 10-in. 300 ft.

Marine Oil Co.'s No. 1-F Winn, Sec. 10-18-13 — Hole full fluid 50% S.W; waiting on air; T.D. 3,604 ft.

(Continued on Page 199)

WORLD'S LARGEST MUD PUMP

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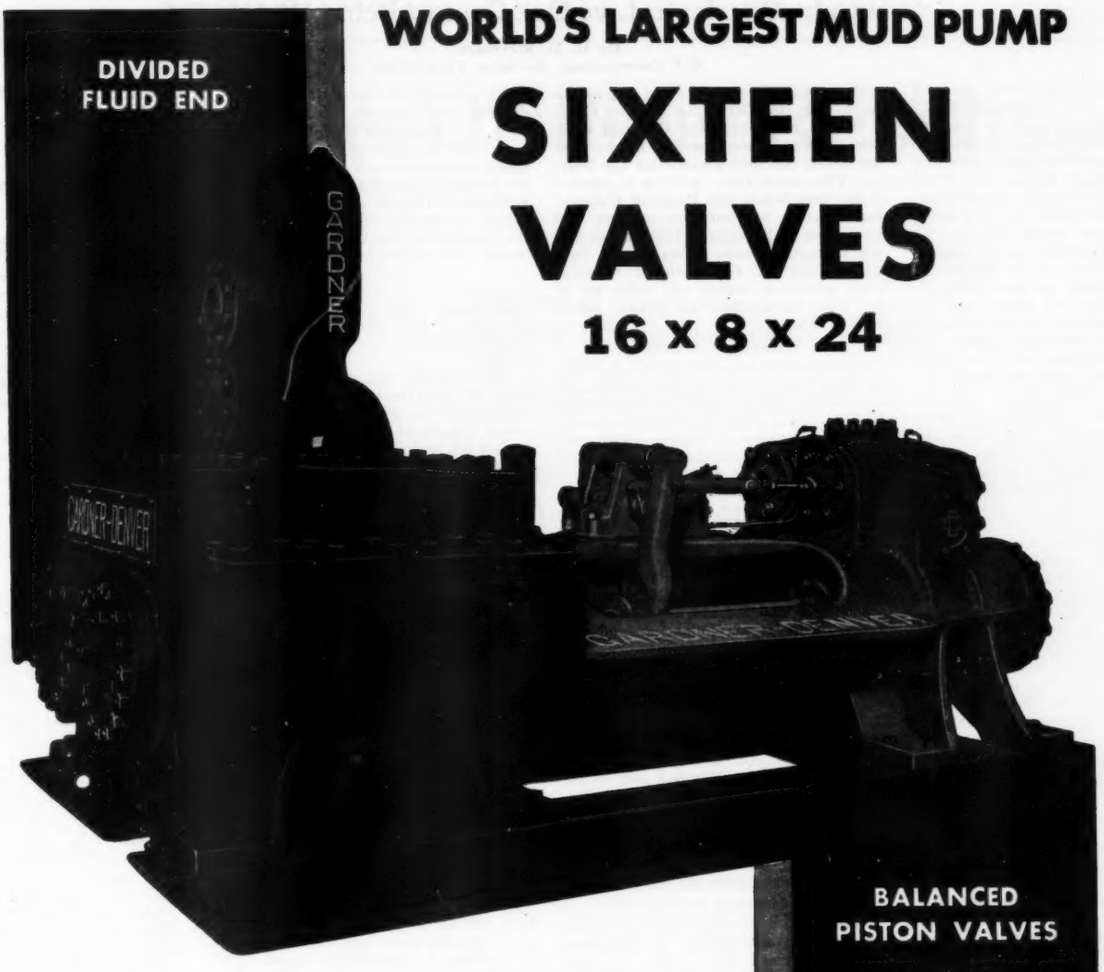

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Good Showing in Kerr County Test

Williamson County Has Five Completions. Cartwright District in Live Oak County Being Watched

By B. D. Stevenson
Staff Correspondent, Southwest Texas Fields

SAN ANTONIO, Tex., Nov. 10.—A good showing of oil in Evans' No. 1 Love ranch, in the southermost of the two southwest corners of Kerr County at 2,545 feet, an apprehension all week long that someone would file an injunction suit against the new 30,000-bbl. daily proration in Darst Creek, and indefinite results on a handful of wildcats over the country that have had good showings, were the main feature of the past week in Southwest Texas.

The Kerr County proposition is pure wildcat as to location. Very little has ever been drilled in that neck of the woods where the Pennsylvanian formation is near enough the top of the ground that it is the main hope for production. The test had about 30 feet of oil standing in the hole at one time. It bailed down after setting casing. A 60-quart shot was tried but failed to help it any and it started drilling deeper. The old Wood-Tex well, on the Clayton land, in western Bandera, 20 miles south and a little east, had quite a showing of oil at one time. In that case the formations were found to be standing pretty much on end instead of lying down as they should have been and though the showing of oil was good the conditions for a well were not favorable.

Darst Creek Proration

Darst Creek the past week began cutting down production in accordance with the Railroad Commission's order to curtail to 30,000 bbls. daily. The industry has been expecting some sort of an injunction from some source to stop the Railroad Commission from enforcing the proration order and it came Saturday at about noon. The field for the week ending November 1 produced an average of 46,055 bbls. daily which is more than 50 per cent above the allowable runs. Saturday attorneys for the Louisiana Oil Refining Co. filed application for an injunction in the Fifty-third District Court at Austin restraining the Railroad Commission from enforcing its new proration order. No date was set for the hearing. This week there will be a number of hearings before the Railroad Commission relative to proration matters and regulations in Southwest Texas fields and two injunction suits affecting the constitutionality of the Railroad Commission's proration orders will come up in the Fifty-third District Court before Judge Calhoun.

Williamson County

Williamson County jumped to the front the past week in the matter of completions and came in with five producing oil wells and a total of 1,350 bbls. initial production. Also a wildcat well, the Schiller-Hruska, 3 miles southeast of the field, was showing some oil at around 2,240 feet with considerable work to do yet before a test can be had. Bottom of the rat hole is 2,275 feet. E. R. Mart's No. 5 T. P. Simmons is going to make about a 400-bbl. well on the pump. It will not flow natural. Stratton & Horn bailed their No. 5 J. C. Abbott and it looks like a well but not as big as many in the field. It may make around 100 bbls. unless it improves some.

Four miles west of the Chapman Field Chapman & Elliott were down 1,100 feet in the No. 1 A. J. Carlson and in the Eagleford.

In the same area but across the county line to the east in Bastrop County, Champion is down 2,390 feet and in the Georgetown and due to go into the Edwards this week, the Edwards being the first good chance for production.

In Milam County Lloyd Oil Corp. and H. W. Elliott on the Davis farm were due to go into the Edwards this week.

Discuss Chapman Posted Price

Conferences were being held in Taylor over the week end relative to the posted price of Chapman Pool crude, the conference being between the new Taylor refinery officials, officials of the Chapman Pipe Line Co. and producers in the field. The producers are asking for 70 cents a barrel at the well. No definite decision was reached.

Producers Completed

A total of 3,273 bbls. of new oil was added to Southwest Texas as a result of 10 producers completed during the week. Williamson County added five wells with initial production of 1,350 bbls. and led the country for the number of wells completed. The record by fields is as follows:

Field—	No. of wells	Initial prodn. bbls.
Darst Creek	2	525
Chapman	5	1,350
Laredo	2	150
Pettus	1	1,248

None of the completions added anything of importance so far as territory is concerned, and all were in the regular sands. The Pettus well is the Union Producing Co.'s No. 23 Ray which offsets the townsite on the east.

Pettus Field

A feature of the Pettus Field is the abandonment of the Humble's No. 8 McKinney, a south offset to the townsite and a south offset to a dry hole. This finally ends things in the southwest corner of the townsite pool with four dry holes heading off production in that direction. Also the activity in the field is now very much reduced. The Union Producing Co.'s No. 25 Ray, with another 1,000 feet to drill, is practically the only other active operation in the field, excepting the No. 1 Mauldin fee which was last reported shut down for fuel. There were some locations announced some time ago but no indications that anything will start on them soon. Also there is no activity in the Ray-McKinney Pool to the east of the townsite, the Cosden Pool to the west or the Grayburg Pool 7 miles southwest.

Pettus Wildcats

Some wildcats in the Pettus area have been having some showings but as the week closed none had developed into propositions of importance. Cosden's No. 1 Stoltzfus, about 3 miles south of the Pettus townsite pool at 4,390 feet, got about 2,000,000 feet of gas but decided to pass it up and drill deeper. Ed Price's No. 2 Weiss, at 4,418 feet, which is about the depth that No. 1 got a good gas showing, also looked like a 2,000,000-foot gasser and it seems showed a little oil on a drill stem test.

The Fort Bend Oil Co.'s No. 1 Newberry, a few miles north of Pettus in Karnes County, had quite a showing but when the test was made failed to show up. It is thought that mechanical trouble prevented it being much of a producer and liner is to be pulled.

In the Simms Pool, several miles southwest of Pettus, the second well is started, and the discovery well is waiting for gas pipe line connections.

Hurlburts' No. 1 Woods, another wildcat in the Pettus area, at 4,232 feet, tested a little gas and swabbed down about 3,000 feet without results and is waiting for longer bailing line.

Southwest Texas Production

Daily average production of the pools in the Southwest Texas area for the week ending November 8 follows:

Bexar	188
Branyon	23
Bruner	14,734
Buchanan	142
Chapman	8,774
Dale	327
Duval	185
Darst Creek	44,628
Kingsville	118
Larremore	32
Luling	9,140
Lytton Springs	743
Manford	280
McMullen	15
Medina	22
Mirando	14,695
Normanna	30
Pettus	7,388
Saxet	55
Somerset	1,457
Yoast	260
Total	103,236
Week ending November 1	118,868
Decrease	15,632

Live Oak County

This week may disclose something interesting in the Cartwright Pool in southeastern Live Oak County, where gas production is had at 2,150 feet. The Houston Oil Co.'s No. 22 Cartwright at more than a mile deep is about ready to test. It has drilled plugs at 5,424 feet. It had

(Continued on Page 206)

SOUTHWEST TEXAS PROVEN AREAS

DOBROWOLSKI POOL—BEXAR COUNTY

Company, farm and location—	Remarks:
Morgan Bros.' No. 3 Masterson, 300 ft. S of No. 2 Masterson, Miguel Gortaris Sur.	T. D. 550 ft.; set csg.
F. H. Eckert's No. 1 Drobrowolski, 400 ft. from W line, 150 ft. from S line of lease, Sur. No. 52	Location.
Pen-Tex Oil Co.'s No. 5 Sandemer, 300 ft. S of No. 4 Sandemer	Location.
Pen-Tex Oil Co.'s No. 6 Sandemer, 300 ft. S of No. 5 Sandemer	Location.
W. R. Swearingen's No. 2 Halberdier, 300 ft. SE of No. 1 J. Perege Sur.	T. D. 460 ft.; drlg.
A. J. Swearingen's No. 6 Sandemer, 600 ft. S of No. 1, M. Manchaca Sur.	Location.
A. J. Swearingen's No. 7 Sandemer, 300 ft. S of No. 6, M. Manchaca Sur.	Location.

DARST CREEK FIELD—GUADALUPE COUNTY

Gulf Production Co.'s No. 9 W. R. Posey	T. D. 2,599 ft.; completed 750 bbls.
Humble Oil & Refining Co.'s No. 2-A Dowdy, NE cor. of "A" lease	Location.
Humble Oil & Refining Co.'s No. 9 D. D. Baker, 450 ft. from E line, 150 ft. from N line of lease, Darst Sur.	T. D. 2,528 ft.; set csg. in Georgetown.
Humble Oil & Refining Co.'s No. 7 Wilson, 150 ft. from N and E lines of lease	T. D. 2,624 ft.; completed initial production 165 bbls. oil.
Humble Oil & Refining Co.'s No. 18-A L. G. Denman	T. D. 2,592 ft.; completed for 850 bbls., flowing.
Humble Oil & Refining Co.'s No. 19 A. L. G. Denman, 2,888 ft. from SE cor., 450 ft. from NE line of lease, Emmett Sur.	T. D. 2,380 ft.; drlg.
Humble Oil & Refining Co.'s No. 20-A Denman, 2,558 ft. from SE cor., 450 ft. from NE line, Denman tract, Emmett Sur.	T. D. 2,110 ft.; drlg.
Humble Oil & Ref. Co.'s No. 1-B Sue Denman, 150 ft. from the N and W lines of lease, in the extreme NE cor. of the J. C. Darst Sur.	Location.
Louisiana Oil Refining Co.'s No. 8 Dix, 664 ft. from NE line, 620 ft. from SE line of lease, Robinson Sur.	T. D. 2,520 ft.; set 6⅝-in. csg.
Louisiana Oil Refining Co.'s No. 9 Dix, 664 ft. from NE line, 1,130 ft. from SE line of lease, Robinson Survey	T. D. 2,509 ft.; set 6⅝-in. csg.

(Continued on Page 205)

WILDCAT OPERATIONS IN SOUTHWEST TEXAS

ATASCOSA COUNTY

Company, farm and location—	Remarks:
Frontier Oil Co.'s No. 2 Boynton, 775 ft. SW of Brown-Fuller gas well	T. D. 2,873 ft.; dry and abnd.

BLANCO COUNTY

Anderson & Manning's No. 1 Speer, 600 ft. to S line, 800 ft. to W line, John W. Speer Sur.	Moving in rig.
Ben H. Ashe Pet. Corp.'s No. 1 Glasscock, moving in to drill on leases out of the Rodson block north of Blanco City	Location.
Hardy-Sitton's No. 1 McMillan	T. D. 570 ft.; running 10-in. csg to set at 560 ft.
Liles-Adams et al's No. 1 Stanford, 150 ft. to S line, 1,420 ft. to E line of James Stanford's No. 155	T. D. 660 ft.; drlg.
McCleary et al's No. 1 Schenling, 900 ft. to SE line, 600 ft. to S line of J. A. Rouse No. 118 Sur., 4 miles SW from Blanco City	T. D. 550 ft.; correction; shut down.
J. R. Meek's No. 1 Walker, 360 rds. from W line, 482 rds. from S line of 375-ac. tract in Sur. No. 23	T. D. 925 ft.; drlg.
G. Rosenfield's No. 1 Hohenberger, 840 ft. to W line, 1,250 ft. to N line, Sur. No. 94	T. D. 640 ft.; drlg.

BASTROP COUNTY

Pacific Oil & Gas Co.'s No. 1 J. M. Litton, 150 ft. N and W lines of tract	T. D. 1,610 ft.; drlg. in Taylor marl.
Majestic Pet. Co.'s No. 1 J. M. Breeding, 160 ft. from N line, 1,020 ft. from W line of 200-ac. tract, 940 varas from W line, 1,225 varas from S line of M. Andrews Sur., 13 miles W from Smithville	T. D. 375 ft.; standing.
Champion et al's No. 1 Smith, 2,541 ft. to NW line, 663 ft. to SW line of tract, T. Standifer Sur.	T. D. 2,370 ft.; drlg. in Georgetown.
Texas Pet. Products Co.'s No. 1 Trigg, Stewart Sur.	T. D. 1,939 ft.; dry and abnd.
R. S. Bolling's No. 1 McWilliams, 150 ft. from N line, 1,111 ft. from W line of Wm. McWilliams tract, Glasscock Sur.	T. D. 950 ft.; drlg.

BROOKS COUNTY

Southern Crude Oil Purchasing Co.'s No. 1 Holbien-Wormser, 900 ft. from E line, 1,000 ft. from S line of Blk. 39, E. P. de Maguellas Sur.	T. D. 4,347 ft.; drlg. shale and lime.

(Continued on Page 202)

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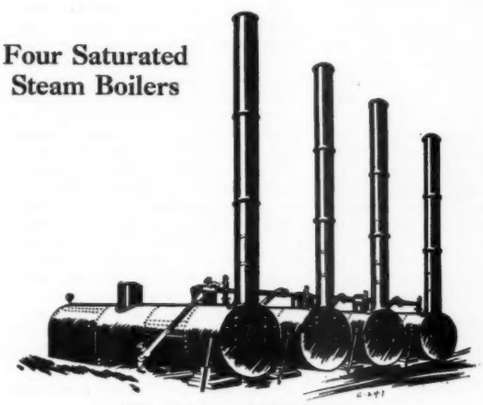
For the Same Drilling Results— You Can Use

Four Saturated Steam Boilers



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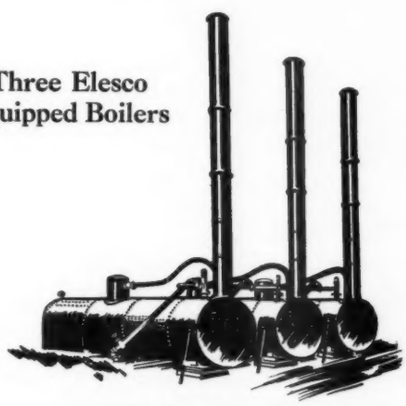

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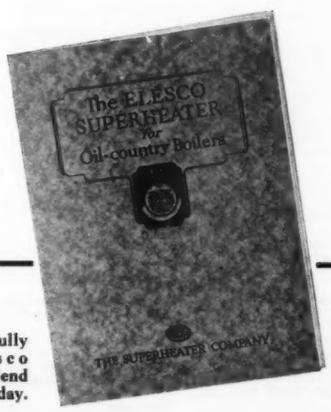

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New Well on Barbers Hill West Flank

Sinclair Company's Test Good for 2,267 Bbls. Further Proves Up New Pool. Coastal Production Declines

By Neil Williams
Staff Correspondent, Gulf Coast Fields

HOUSTON, Tex., Nov. 10.—The west flank of the Barbers Hill Dome as a potential producing area was further indicated the past week with the completion of the second good well in the recently opened pool on the extreme west. This well, Sinclair Oil & Gas Co.'s No. 1 Smith, was the of particular interest in the Gulf Coast. Produconly new development tion, which has been declining steadily for some time, showed further loss with the total output now down to 180,463 bbls. daily.

The Smith well came in flowing 2,267 bbls. of pipe line oil in the first 24 hours, production being through two half-inch chokes from sand at a total depth of 5,512 feet with six joints of screen set on bottom. The well pressure is 430 pounds and the gravity of the oil 31.9°. This well is a direct offset to and 100 feet west of Sun Oil Co.'s No. 1 O. K. Winfree, the first well on the extreme west side of the dome, completed late in August for 1,200 bbls. daily on a half-inch choke. Being closer to the dome, the Winfree well ran higher, being completed at a total depth of 5,328 feet. The latter was located upon the dome and drilled through several hundred feet of cap rock to reach the oil pay.

The area in which these two wells have been completed is strictly wildcat territory, being some 2,000 feet to the south of production on the northwest flank of the dome and approximately 4,000 feet northward from wells on the southwest flank. Following completion of the Sinclair company's well, Yount Lee Oil Co. has made location for its No. 1 O. K. Winfree in the same area. Humphreys Corp.'s No. 1 O. K. Winfree, north offset to the Sun discovery well, late in the week was drilling in hard sand rock at 4,296 feet, and Sinclair's No. 2 Smith in the same group and a west offset to Humphreys' test was drilling water sand at 5,227 feet.

Rio Bravo Oil Co., however, failed to extend the production on the southwest side northward in its No. 1 Fisher fee, which after drilling to 6,757 feet in hard sand, was abandoned as dry. This test is approximately 1,000 feet to the north of Mills Bennett Production Co.'s No. 1 Henry Fisher, the northernmost of the three deep wells so far completed in that area and between them and the Sun and Sinclair west side wells. These wells have found pay in sands above 6,600 feet.

Completion in the Refugio district the past week were limited to two gas wells although at the close of the week several deep wells were swabbing. General interest in Refugio has been at low ebb for some time although a consistent proving up of the deep horizons, particularly the newer 6,400-6,500-foot sand, has kept up. Developments in this sand lately have been more encouraging with the completion of several good wells, which have spread the producing area over considerable territory. Several of the new wells have necessitated the starting up of new drilling as offsets and the deepening of wells from shallower sands.

Big Gasser in 6,400-foot Sand

Independent Oil & Gas Co. got a gas well in the 6,400-foot sand in its No. 1 Mercy Academy on the south edge of the deep producing district. This well, which has been drilling since January, first made a small oil well in the 5,400-foot horizon at a depth of 5,384 feet but with the new 6,400-foot activity it has been deepened to sand at 6,375-6,423 feet, where it is making an estimated 40,000,000 feet of dry gas, 2,300 pounds pressure through a three-eighths-inch choke. This well necessitates the deepening of Union Producing Co.'s No. 2 Mitchell, the east offset, which was completed early in January, flowing 21 bbls. hourly from sand at 5,448-61 feet. The latter well was the second deep sand producer at Refugio, previous production, except for the deep sand discovery well (Union Producing Co.'s No. 1 O'Brien), having been from the 3,700-foot sand. Its completion last January extended the deep production of the discovery well more than a mile to the southeast and since that time all the intervening territory has been proved up, not only in the 5,400-foot sand but also in the 5,600-5,700-foot sand and the newer 6,400-6,500-foot horizon. In addition, although the Mitchell well and Independent's Mercy Academy well remain virtually the southermost edge, the deep sand area has been extended a substantial distance to the north, east and west of the discovery well.

Deep Gasser in Refugio

Independent Oil & Gas Co. finally has completed its No. 6 Jerry Reilly as a dry gas well in sand at 3,637-59 feet. This well, located in the heart of the old producing area, was drilled to a total depth of 7,618 feet, the second deepest hole at Refugio, in an effort to prove the extent of the deep horizons under the field. Deep production has been confined chiefly to the east side of the old 3,700-foot producing field. Moody-Seagraves Producing Co.'s No. 1 Linney, Block 42, town lots, and in the center of the deep sand development, has been abandoned. This well blew out while drilling at 4,880 feet, and operators have not been able to complete it successfully.

On the north side of Pierce Junction, Shaw and associates deepened their No. 2-B Fitzgerald as a workover and set 1 joint of screen at 4,803 feet. The well came in flowing 500 bbls. daily of 29.2 gravity oil. The only other completion of the weeks were Rio Bravo Oil Co.'s No. 100-B Cotton, Saratoga, good for 17 bbls. daily at 150 feet; Yount Lee Oil Co.'s No. 32 State, Hackberry, which flowed initially 655 bbls. net oil daily, 3,903-09 feet, and McAlbert Oil Co.'s No. 2 Wilburn, a former producer on the east flank of Barbers Hill, deepened to 5,733 feet and put on the pump for 85 bbls. of fluid, 30 per cent salt water.

Among abandonments of the week was Rycade Oil Corp.'s No. 1 Heiskell, Joseph Dugat Survey, southern Liberty County, which was dry at 5,927 feet. This was the first test drilled on this geophysical salt dome prospect checked early this year with the seismograph. It is located several miles to the west of the Moss Bluff Dome and north of the Lost Lake Dome of northern Chambers County. A half dozen other scattered routine abandonments were reported.

New Salt Dome Test

In line with the general curtailment program, new work started the past week was lighter than in the past year. Not a half dozen new locations were made and comparatively few old wells were started into to deepen. However, among the new tests starting is one of some interest, this being Vacuum Oil Co.'s No. 1 Wait, 225 feet out of the SE cor., Section 12-9s-7w, eastern Calcasieu Parish, Louisiana. This location, for which a derrick has been built, is on what is known as the Iowa geophysical salt dome prospect. It will be the first test drilled in this area. Shell Petroleum Corp. made a location earlier in the year but this so far has not been drilled. Another new location was made at Mykawa, southeast of Houston, by Abercrombie & Harrison on the Gerring tract, William Lovett Survey.

Production Decline Continues

Daily average production of Coastal fields for the week ended November 8 was the lowest it has been since the first week in January when it was 177,226 bbls. Figures by fields were:

SOUTHEAST TEXAS	
Allen	23
Barbers Hill	20,362
Batson	1,078
Big Creek	3,609
Blue Ridge	1,632
Brenham	147
Boling	1,006
Clay Creek	2,295
Damon Mound	735
DeWalt	12,031
Esperson (Sheeks)	3,024
Fannett	632
Goose Creek	4,492
Hankamer	2,181
High Island	829
Hull	7,411
Humble	14,433
Jasper County	25
Lost Lake	454
Markham	201
Moss Bluff	65
Mykawa	253
Nash	228
North Dayton	1,435
Orange	2,008
Orchard	2,309
Pierce Junction	11,134
Port Neches	1,129
Raccoon Bend	8,359
Refugio	24,505
Saratoga	1,289
Sour Lake	2,195
South Liberty	3,094
Spindletop	13,811
West Columbia	4,211
Total Southeast Texas	152,658
Total week ending November 1	155,883
Decrease	3,225

SOUTH LOUISIANA	
Anse La Butte	7
Bayou Blue	55
Bayou Bouillon	119
Black Bayou	1,480
Edgerly	384
Jennings	2,018
Hackberry	2,960
Lake Barre	2,371
Lake Pelto	102
Lockport	3,953
Port Barre	2,700
Sorrento	65
Starks	664
Sulphur	3,100
Sweet Lake	1,155
Vinton	5,457
Welsh	121
White Castle	1,064
Total South Louisiana	27,805
Week ending November 1	27,019
Increase	786
Total Gulf Coast	180,463
Week ending November 1	182,902
Decrease	2,439

GULF COAST FIELDS AND WILDCATS

Week Ending November 8
All Rotary

BARBERS HILL—CHAMBERS COUNTY

Mills Bennett Prod. Co.'s No. 4 Barber, north ..... Drlg. rock 1,308 ft.
Mills Bennett Prod. Co.'s No. 3 Gulf Fisher, south ..... Rigging up.
Humble Oil & Ref. Co.'s No. 6 fee, west ..... Cleaned hole 6,602 ft.; resuming drlg.
Humphreys Corp.'s No. 1-B Barber, north ..... Shale 6,793 ft.; drill stem stuck.
Humphrey Corp.'s No. 2-B Barber, north ..... Rigging up.
Humphreys Corp.'s No. 6-A Barber, northwest ..... Total depth 4,449 ft.; set 8¼-in. casing.
Humphrey Corp's No. 1 Louise Fitzgerald, north ..... Rigging up.
Humphreys Corp.'s No. 1 Morgan (workover) ..... To sidetrack; total depth 6,404 ft.
Humphreys Corp.'s No. 8-B Kirby, northwest ..... Drlg. sand and shale 4,478 ft.
Humphreys Corp.'s No. 10-A Kirby (workover) ..... Drlg. shale and lime 2,804 ft.
Humphreys Corp.'s No. 1 Winfree, west ..... Drlg. hard sand rock 4,292 ft.
McAlbert Oil Co.'s No. 1-B Higgins, east ..... Oil sand 5,225 ft.; set csg. at 6,180 ft.
McAlbert Oil Co.'s No. 2 Wilhorn ..... Comp. pumping 85 bbls., 30% salt water 5,733 ft.
Republic Prod. Co.'s No. 2 Kirby (workover) ..... Swabbing 6,700 ft.
Rio Bravo Oil Co.'s No. 1 Fisher, southwest ..... Abandoned 6,757 ft.; hard sand rock.
Sinclair Oil & Gas Co.'s No. 1 Smith, west ..... Set 6 jts. screen 5,512 ft.; comp. flowing 2,260 bbls. on two ½-in. chokes, 31.9 gravity, pressure 430 pounds.
Sinclair Oil & Gas Co.'s No. 2 Smith, west ..... Drlg. water sand 5,227 ft.
Sun Oil Co.'s No. 5 Chambers (workover) ..... Drlg. shale 5,126 ft.
Sun Oil Co.'s No. 6 Chambers (workover) ..... Drlg. shale 5,156 ft.
Sun Oil Co.'s No. 7 Chambers, south ..... Drlg. rock 2,406 ft.
Sun Oil Co.'s No. 12 Wilburn fee, east ..... Drlg. shale and lime 4,423 ft.
Sun Oil Co.'s No. 13 Wilburn fee, east ..... Rig.
Sun Oil Co.'s No. 1 Zadie Fisher, southwest ..... Drlg. sandy shale 5,594 ft.
The Texas Company's No. 1 Williams, southwest ..... Pulling liner 5,932 ft.
The Texas Company's No. 1 Winfree, west ..... Drlg. hard sand, lime and pyrites 4,490 ft.
Yount Lee Oil Co.'s No. 1 Hindman, southwest ..... Drlg. hard sand 6,608 ft.
Yount Lee Oil Co.'s No. 16 Chambers, south ..... Drlg. hard sand and lime 4,410 ft.
Yount Lee Oil Co.'s No. 3 Fisher, southeast ..... Drlg. hard sand 6,712 ft.
Yount Lee Oil Co.'s No. 6 Phillips, east ..... Waiting on orders.
Yount Lee Oil Co.'s No. 1 Winfree, west ..... Derrick.

RACCOON BEND—AUSTIN COUNTY

Humble & Valley's No. 2 Duncan-State ..... Pulling liner and screen 3,425 ft.
Humble & Valley's No. 3-B Hardy ..... Derrick.
Humble & Valley's No. 9 Mueller ..... Derrick.
Humble & Valley's No. 7 Payne ..... Derrick.
Humble & Valley's No. 8 Payne ..... Derrick.
Humble & Valley's No. 1-B Reese ..... Drlg. shale 3,853 ft.
Humble & Valley's No. 1-B Remmert ..... Drlg. sandy shale and shell 3,090 ft.
Humble & Valley's No. 6 Saunders ..... Derrick.
Humble & Valley's No. 2 Sherrod ..... Derrick.
Humble & Valley's No. 11 Thompson ..... Drlg. shale and shell 3,089 ft.
Humble & Valley's No. 6 Woodley ..... Derrick.
Humble & Valley's No. 7 Woodley ..... Derrick.
Humble & Valley's No. 8 Woodley ..... Derrick.
Humble & Valley's No. 9 Woodley ..... Derrick.
Humble & Valley's No. 10 Woodley ..... Drlg. shale and lime 1,745 ft.

HUMBLE—HARRIS COUNTY

Cullen West's No. 5 Lee, south ..... Drlg. shale and lime 2,860 ft.
John Deering No. 2 Bennett ..... Drlg. hard lime 3,379 ft.
P. S. Griffith's No. 1 fee ..... Spudded.
LaRue trustee's No. 1 Crane, northwest ..... Derrick.
M. LaRue trustee's No. 1 Tuffly, northwest ..... Drlg. gumbo and sand 1,405 ft.
South Texas Pet. Co.'s No. 3 Burt, east ..... Drlg. gumbo 3,430 ft.
South Texas Pet. Co.'s No. 3 Lee (workover) ..... Comp. pumping 90 bbls. 5,393 ft.
Sun Oil Co.'s No. 13 Bender (workover) ..... Rig up to workover 4,589 ft.
Sun Oil Co.'s No. 14 Bender, west ..... Drlg. rock 5,142 ft.
Sun Oil Co.'s No. 16 Bender ..... Derrick.
Sun Oil Co.'s No. 18 Bender ..... Drlg. sandy shale 3,145 ft.
Sun Oil Co.'s No. 49 River, north ..... Drlg. sand and shale 5,381 ft.

(Continued on Page 201)

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CONTINENTAL

Eastern Edge of Hobbs Pool Found

Sulphur Water on Southeastern End of Field. Pool's Potential Set at 901,255 Bbls. Good Well in Osage

By Tolbert R. Ingram
Staff Correspondent, Rocky Mountain Area

DENVER, Colo., Nov. 10.—The edge of the Hobbs Pool in Lea County, New Mexico, on the eastern side of the southeastern end of the field, was found in the Hobbs High, Inc.'s No. 1 Tatum, which had sulphur water at 4,315 feet. The potential production of the pool on November 1 was set at 901,255 bbls. daily by the proration committee. Three completions were reported the past week, the best being Amerada Petroleum Corp.'s No. 3-B State for 19,667 bbls. Activity in the Eunice area continues to increase and Atlantic Oil Producing Co. has revived its No. 1 Coleman abandoned location.

Drilling in of the Platte Valley Petroleum Co.'s discovery well on the Greasewood Dome in Colorado has been postponed indefinitely, but there has been no letup in the scouting of that part of the State by geologists. A Lakota sand test on the Wellington Dome is reported to have disclosed water in that horizon. Two dry holes were reported in Fremont County and two new operations are starting in Archuleta County. The Texas Production Co. has a good shale well on the Tow Creek structure in Routt County.

A well flowing 600 bbls. a day has been completed by the Lambie Oil Co. in its No. 3 Bock in the Osage Field in Wyoming. The Empire State Oil Co. had a small well at Iron Mountain and the Baggs Oil Co. is starting a well on the Baggs Dome in Carbon County.

NEW MEXICO

Hobbs Pool—Lea County

The potential production of the Hobbs Pool on November 1, as established by the executive committe for proration purposes, was 901,255 bbls. daily from 114 wells on 101 units of 40 acres each. This compares with 819,193 bbls. daily from 106 wells on 95 units on October 16 and 678,406 bbls. daily from 89 wells on 79 units on October 1. The figures show an increase of 222,849 bbls. in the potential capacity of the wells, 25 in the number of wells on production and 22 in the number of units during the month of October. The daily allowable production for the first half of November was placed at 31,300 bbls., which compares with 31,715 bbls. daily for the last half of October and 32,340 bbls. for the first half of that month.

The edge of the Hobbs Pool on the eastern side of the southeastern part was found this week in Hobbs High, Inc.'s No. 1 Tatum, NW SW SW, Section 35-18-38, which is on the east side of the town of Hobbs and 2 miles east of the Continental Oil Co.'s No. 1-B State, SW SW, Section 33, the nearest producer in that direction. It is bottomed at 4,315 feet with a hole full of sulphur water. The water was encountered at 4,313-15 feet and rose 800 feet in seven hours. There was a slight show of oil at 4,310-12 feet. The elevation of this well is 3,609 feet and the top of the lime was 3,075 feet. It is about 275 feet down structure. The Midwest Refining Co. is drilling just midway between the Hobbs High and the Continental wells in its No. 29 Turner in the SW SW, Section 34, and it is expected to locate the water line more definitely on that side of the pool.

Three Completions

Three completions were reported as follows:

Amerada Petroleum Corp.'s No. 3-B State, SE NW NE, Section 29-18-38, gauged 1,016 bbls. in 1 hour and 25 minutes open flow at a total depth of 4,192 feet and it was given a potential of 19,667 bbls. of oil and 12,000,000 feet of gas. It is an inside well and did not prove up any additional territory.

Atlantic Oil Producing Co.'s No. 1 Grimes, SW cor. SE, Section 20-18-38, was rated at 3,078 bbls. of oil and 2,500,000 feet of gas per day. The total depth is 4,242 feet and 3-inch tubing was run to 4,220 feet. The pay was at 4,163-4,242 feet and top of brown lime was at 2,875 feet. The elevation is 3,648 feet. This is an outside well on the northeastern side of the structure, being one location east of the Shell Petroleum Corp.'s No. 2-B McKinley.

Sun Oil Co.'s No. 3 McKinley, NW cor. NE, Section 5-19-38, was completed at a total depth of 4,175 feet and was given a potential rating of 8,812 bbls. of oil and 10,000,000 feet of gas per day. The pay was at 3,970-4,175 feet and tubing is at 4,148 feet. Top of the brown lime was at 2,778 feet and elevation is 3,630 feet. The Ohio, Midwest and Gypsy companies have offsets.

There were no new locations made the past week and one location recently made was indefinitely suspended. This was the Humble Oil & Refining Co.'s No. 11-A Bowers, SW NW NW, Section 29-18-38. If the company had gone ahead with this well it would have called for one or more offsets.

Drilling Operations

Routine operations include the following:

Amerada Petroleum Corp.'s No. 4-B State, NE cor. NW, Section 29-18-38, cemented the 7-inch at 4,007 feet.

Cecil Bordages' No. 1 Hughes, C S half, Section 27-19-38, is repairing rig and getting ready to resume. It was shut down at 4,012 feet last March and since then has not made any new hole though some work was done in swedging collapsed pipe and cementing. It is 2 miles due south of the most southerly producer. The well was started in August, 1927. It has had several small shows of oil.

The California Co.'s No. 3 State, SE cor., Section 29-18-38, is testing at a total depth of 4,175 feet, and its No. 4 State, SW cor. SE, Section 29-18-38, is testing at a total depth of 4,170 feet. The last named made 396 bbls. of oil in one hour on a company gauge and 17,280,000 feet of gas.

Continental Oil Co.'s No. 1-C State, C NW SE, Section 5-19-38, is drilling at 1,110 feet in red rock.

Empire Gas & Fuel Co.'s No. 3 Hardin, SE NE NW, Section 19-18-38, is drilling at 2,881 feet in lime and and anhydrite. It topped the brown lime at 2,230 feet and had first gas at 2,835 feet. Same company's No. 3 Fowler, SW cor. NE, Section 31-18-38, is drilling at 3,750 feet in anhydrite and lime and had first oil at 3,199 feet.

Humble Operations

The Humble Oil & Refining Co.'s No. 2-A State, SE cor., Section 25-18-37, topped brown lime at 2,893 feet, had first gas at 2,905 feet and is drilling in anhydrite at 3,365 feet. Same company's No. 3-A State, C NW SE, Section 25-18-37, spudded on October 27 and cemented 12½-inch at 207 feet in the red beds.

Mid-Continent Oil Co.'s No. 1 Fowler, NE NW NW, Section 31-18-38, is drilling at 2,925 feet in anhydrite and had first gas at 2,871 feet.

Midwest Refining Co.'s No. 26 State, C SE SW, Section 4-19-38, is drilling at 3,580 feet in anhydrite, and its No. 11 Thorpe, C NE NW, Section 10-19-38, has cellar completed. Same company's No. 11 State, C NE NW, Section 9-18-38, is rigging up, and its No. 26 McKinley, C SE NW, Section 5-19-38, is ready to spud. Midwest's No. 29 Turner, C SW SW, Section 34-18-38, is drilling at 3,101 feet in anhydrite.

National Securities Oil Co.'s No. 1 Linam, NE SE SW, Section 33-18-37, is rigging up rotary.

Ohio Oil Co.'s No. 4 State, SW cor., Section 30-18-38, cemented 9⅝-inch at 2,750 feet.

Shell Petroleum Corp.'s No. 2 Berry, NW cor. SE, Section 31-18-38, is drilling at 3,778 feet in anhydrite. It topped brown lime at 2,850 feet and first gas at 2,850 feet and first oil at 3,216-36 feet. Elevation is 3,641 feet. Same company's No. 8 McKinley, C N half N half SE, Section 19-18-38, is drilling at 3,660 feet in anhydrite. It topped brown lime at 2,870 feet and elevation is 3,657 feet.

Skelly Oil Co.'s No. 2 Fowler, SE cor. NW, Section 31-18-38, is drilling at 3,660 feet in anhydrite. It topped brown lime at 2,830 feet and had first gas at 2,849 feet and first oil at 3,228 feet. Elevation is 3,646 feet.

Sun Oil Co.'s No. 4 McKinley, C SW NE, Section 5-19-38, spudded on October 25 and cemented 12½-inch at 175 feet.

The Texas Pacific Coal & Oil Co.'s No. 2-G State, NE cor. SE, Section 24-18-37, is bottomed at 4,208 feet and drilling at is bottomed at 4,208 feet and drilling outside 7-inch after cementing the whipstock at 3,750 feet.

The Texas Company's No. 3-C State, C SW NE, Section 25-18-37, is rigging up.

Tidal Oil Co.'s No. 4 Grimes, SE cor. NE, Section 29-18-38, cemented 9⅝-inch at 2,720 feet, and its No. 2 Hardin, SW SE NE, Section 19-18-38, cemented 7-inch at 3,950 feet. Same company's No. 3 Hardin, SW NW NE, Section 19-18-38, cemented 7-inch at 3,952 feet.

Vacuum Oil Co.'s No. 1 Berry, NE cor.

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NEW SOUTH TURNER VALLEY WELL NEARING COMMERCIAL PRODUCTION

By Victor Lauriston
Staff Correspondent, Canadian Fields

CHATHAM, Ontario, Nov. 8.—In South Turner Valley, Calmont Oils' No. 4, LSD 11, Section 20-19-2w5, is drilling 202 feet in the lime at 5,030 feet depth with good gas showings and is thought to be near commercial production. This test is fairly close to Calmont's No. 2 which some months ago got a record wet gas production, around 42,500,000 feet, from the lime, though No. 2 was higher on structure.

In Section 16-19-2w5, East Crest Oil Co.'s No. 2-A, LSD 4, is reported maintaining steady production, with no trouble from freezing. With heavy back pressure, close to 1,200 pounds, the well has made a peak of about 612 bbls., which intermittently declines to 450 or 500 bbls. when carbon collects. To remedy this the well is blown and the larger production comes back. East Crest's No. 2-A is reported to have made approximately 15,000 bbls. in October. East Crest's No. 3, same LSD, is cementing cellar. Boller, Sherman & Boller of Tulsa have the drilling contract.

In Section 4-19-2w5, Miracle Oils' No. 1, LSD 11, is reported making around 366 bbls. with a wet gas flow of only 14,000,000 feet, indicating the wet gas in this area is possibly richer than in the majority of wells. Miracle's No. 2 has been located on a 40-acre tract in the northeast corner of Section 5-19-2w5, taken over from Askalta Oils, Ltd. This acreage is on the west side of the structure, west of the Mercury holdings and south of the Southwest Petroleum Co.'s acreage in Section 8, and north of Spray Oils' 20-acre tract in Section 9. Askalta Oils' No. 1 was located some time ago in LSD 16, Section 5-19-2w5, and cellar dug; and Miracle Oils' No. 2 will use the same location and cellar. It is expected to spud in this month. Mercury Oils' No. 3, LSD 2, Section 4-19-2w5, is making around 230 bbls.

Central Turner Valley

In Central Turner Valley, Midfield Oil Co.'s No. 1, LSD 9, Section 1-20-3w5, is unofficially reported making around 200 bbls. a day from the lime. Production is being delivered to Regal Oil & Refining Co. Sioux City Oils' No. 1, LSD 10, deep test, is reported standing at 6,043 feet, corrected depth, with a fair flow of gas and may make a production test. This test at 1.642 feet in the lime has apparently established a record depth for the lime horizon, though it is still 557 feet short of the depth record for Canada established a couple of years ago by British Dominion's No. 1.

In Section 12-20-3w5, LSD 14, New McDougall-Segur's No. 2, is deepening at 5,497 feet, about 400 feet in the limestone, with additional gas. No. 3, same LSD, has been cased and cemented at 5,425 feet owing to caving; the gas flow is reported increasing. No. 4 is reported making slightly over 70 bbls. from the lime.

Spooner Oils' No. 4, LSD 4, Section 13-20-3w5, entered the lime at 5,070 feet. No. 1 is reported making 90 bbls. and No. 2 making 50 bbls.

North Turner Valley

Some new activity is reported in the North Turner Valley area where Foothills' No. 1 and Model Oils' No. 1 are so far the only commercial producers. United Oils' No. 4, Section 24-20-3w5, bottoming at 5,398 feet, is sidetracking damaged casing. It is in the Dakota horizon at 4,180 feet. It got a small light crude production, as high as 40 bbls., from the Dalhousie sand, but when the light crude declined, it was decided to carry the test to the deep lime.

Foothills Test in Lime

On the Herron structure, in the foothills north and west of the Turner Valley, Herron Petroleum's No. 1, LSD 3, Section 13-22-6w5, is drilling 275 feet in the lime at 2,975 feet depth. Some gas has been encountered, and commercial production seems possible in this horizon.

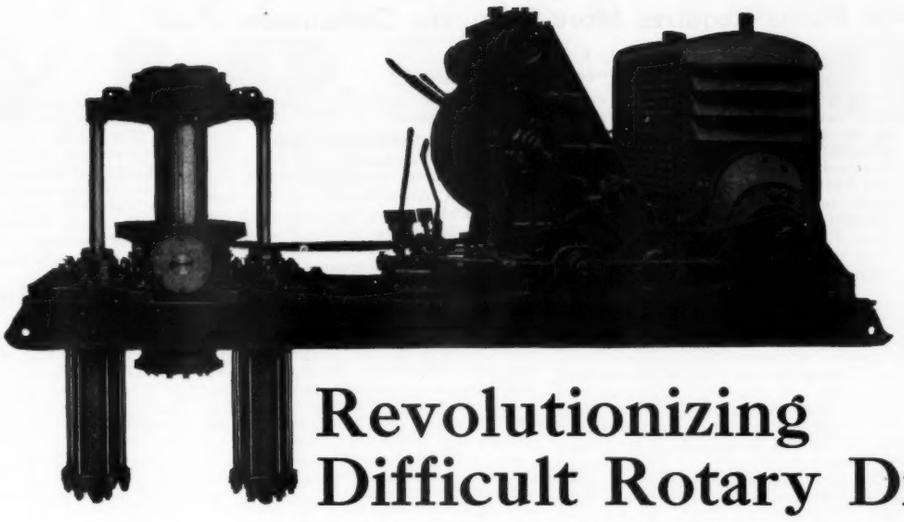
In the Pincher Creek area, Weymarn Petroleum's No. 2, LSD 5, Section 7-6-1w5, has resumed drilling at 2,024 feet after running casing, following a shot. The test has some wet gas, but will be deepened for larger production.

Border Fields

In the Warner district Anglo-Western Oils' No. 1 Despot, LSD 1, Section 12-4-17w4, spudded in recently and is reported drilling below 170 feet. It is 2 miles east of Warner in an untested section of the Milk River area. The field manager is H. E. Hanson.

In the Milk River district, Commonwealth Petroleums' No. 1, LSD 9, Section 9-3-17w4, is reported making hole below 4,475 feet after a second water

(Continued on Page 262)



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SHELDON HYDRAULIC ROTARY TABLES

Serious Problem Faces Californians

Threat of Demoralizing Volume of High Grade Oil From New Fields Requires More Stringent Curtailment Plan

By L. P. Stockman
Staff Correspondent, California Fields

LOS ANGELES, Calif., Nov. 8.—With drilling operations progressing at a normal rate in the Lost Hills-Belridge area of Kern County, and additional production expected to be opened up in the Kettleman Hills Field, irrespective of whether the double unit plan now under consideration is ultimately ratified, the operators' general committee is faced with the necessity of reducing production in other fields to an absolute minimum in order to alleviate conditions as much as possible. As a forerunner, the advisory committee recently completed a detailed survey and in accordance with its findings reduced the potential daily production of Santa Fe Springs, Long Beach and Kettleman Hills and increased the potential of Elwood, Ventura Avenue and Playa Del Rey. The net result of this check was a reduction in the State's potential daily production of 36,180 bbls., bringing California's daily potential down from 1,186,150 bbls. to 1,149,970 bbls. This is more in line with The Oil and Gas Journal's survey published a few weeks ago but is still somewhat in excess of conservative estimates.

Under the new proration schedule, the potential of San Fe Springs is set at 144,800 bbls. per day, which, on the basis of an allotment of 90,000 bbls. and a current production of 93,585 bbls. per day, indicates a curtailment of 37.85 per cent. By decreasing the potential daily production of Santa Fe Springs 32,065 bbls., the advisory committee strengthened the position of Long Beach as the biggest factor in current production. This field, with a daily potential production of 202,850 bbls., is by far the most important contributor to current production at the present time and will probably be the next field to receive special consideration to determine its actual potential. The feeling is quite general among engineers that Long Beach is not capable of attaining its present rated potential just as it failed to reach its original rating on the five-day flow test conducted last March.

Deeper Curtailment Necessary

It becomes more evident as time goes on that California operators will be obliged to effect a much more stringent curtailment program if any hope is entertained of preventing demoralization of the general price structure. The production of extremely high gravity oil and large volume of natural gas which will emanate from the Kettleman Hills and Lost Hills-Belridge Fieds next year, unless restricted by the gas conservation law, will precipitate a crisis of grave importance. In order to cope with this 60 gravity crude oil, containing in excess of 75 per cent gasoline, producers will be compelled to effect drastic reductions in fields producing oil of inferior quality. The necessity of effecting an additional curtailment is quite evident when one considers the relative importance of various California crudes from a refining standpoint. For each barrel of crude oil produced at Kettleman Hills 2 bbls. must be restricted in other fields.

The only way that this additional curtailment may be avoided will be through enforcement of the gas conservation law or some other method of compulsory restriction. As far as the California gas conservation law is concerned, no immediate aid is anticipated, notwithstanding recent favorable decisions. The constitutionality and validity of the gas law has not yet been definitely determined and it remains to be seen whether this regulatory legislation will ever become an important factor. Two superior courts have passed favorably upon the validity of the gas conservation law up to the present time but no opinion has been rendered by the State supreme court or the United States district court of appeals, each of which has the law under consideration. In the Kettleman Hills case, Judge Strother's decision exceeded even the most sanguine expectations of conservationists.

Judge Strother's Ruling

In this case Judge Strother ruled that, "the title to realty can only be acquired adversely by prescription and that is totally foreign to the idea of prescription. It is the law of every sovereignty, expressly made the statutory law of this State—recognized, rather, and codified as the law of this State both in the political code and in the civil code, that the State is the ultimate owner of all property, both real and personal, and that any property which has no other owner is the property of the State. That, of itself, resolves, of course, all the questions as to the constitutionality of the act, because it is more than an exercise of the police power; it is the exercise of the right of the dominant owner. It is my opinion that it is perfectly competent for the State to provide for a division among all operators and all owners, regardless of whether they are operators or not, or whether their lands have been developed or not, if it can be established that those operating and drawing from this field are—that it is all one deposit, that as between the owners, division may be made with such apportionment as might be equitable between the different parties of the expenses of the development; that the State has an absolute right to control the development and to control the division of any profits that may arise from such development as has taken place, as I say, equitably charging against those who have no development, their proportionate share of the expense of the development. Now, this conclusion of mine is not only, to my mind, inescapable but it is to the best interests of the people of the State of California and it provides a means, if it should be confirmed by the other jurisdictions of judicial departments of the State, of better protecting those who have interests in lands lying in any gas or oil deposit than any other condition that could exist, or any other state of title that could exist. I don't think, gentlemen, it is necessary to say any more."

Long Beach Developments

The Star Petroleum Co. is believed to have proved up a new deeper zone in the Los Cerritos section of the Long Beach Field during the past week and other wells drilling in this area are expected to be carried down into this new flush horizon. The existence of this probable new zone became evident when the Star's No. 2 Colby blew in during the course of a water test flowing 512 bbls. of exceptionally clean 30.7 gravity oil and 2,100,000 feet of natural gas per day from 8,549 feet. This well, a former upper zone producer, came in under a natural flow after the cement had been drilled out and the bit carried 5 feet below the shoe of the 4¾-inch water string landed at 8,480 feet. The well was still flowing late yesterday afternoon but preparations are being made to clean out the hole to bottom and finish in the customary manner in as much as the hole is at the present time open from 8,480 feet to 8,549 feet.

In addition to this new deep zone discovery, there were other wells finished in the Long Beach Field during the past seven-day period. Otis Hoyt successfully completed his No. 11 Signal in the extreme southeastern part of the field and although this well failed to result in a natural flow it was good for 400 bbls. of clean 28.5 gravity oil per day from 6,990 feet. In the Lovelady Pool, located in the center of the Long Beach Field, The Texas Company recompleted No. 4 Robinson, a former upper zone producer flowing 260 bbls. per day from 7,168 feet. In the Los Cerritos section, Woods & Callahan finished No. 4 Long Beach flowing 230 bbls. of 25.3 gravity oil per day from 7,546 feet and, while the output is still cutting in excess of pipe line specifications, the well seems to be clearing up. The McFarland Syndicate's No. 1 Signal also showed a rather high cut upon completion as this well carried down to 5,928 feet and subsequently plugged back to 5,875 feet, is flowing 260 bbls. of 24.6 gravity oil cutting 10 per cent. The Delaney Petroleum Co. successfully recompleted No. 1 Just, after redrilling and deepening it to 7,444 feet and, while it did not respond with a natural flow, it was good for 210 bbls. per day on a compressor. The Jameco Oil Co. also chalked up a recompletion during the past week when No. 6 Signal was returned to production flowing 230 bbls. of 27.6 gravity oil after being redrilled and deepened to 7,451 feet. The Dabney-Johnston Oil Corp.'s No. 76 Signal, completed 10 days ago, has been beaned back to 2,550 bbls. per day. Before being pinched back, however, this well registered a potential of 3,450 bbls. flowing throw two 1-inch beans under a pressure of 955 pounds.

Playa Del Rey

There were several good wells finished in the Playa Del Rey Field of Los Angeles Basin during the past week and a check indicates the probable completion of a number of additional potential producers during the next 15 days. The best well finished this week was the Elmer Oil Co.'s No. 4 Venice, which came in flowing 1,760 bbls. of 23.4 gravity oil per day from the Recreation zone at 6,060 feet. The Goodfield Petroleum Co.'s No. 3 Venice was another satisfactory completion chalked up this week as it registered an initial of 740 bbls. per day from the Del Rey zone at 4,481 feet. The Venice Oil Syndicate finished two new wells during the past seven-day period, neither of which, however, was exceptionally productive. No. 3 Venice, bottomed at 6,093 feet and finished with a 4¾-inch liner carrying 220 feet of perforated, was good for 310 bbls. per day, while No. 4 Venice, another new well, was good for 310 bbls. per day from 4,432 feet, the hole having been plugged back from 5,870 feet and finished with a 6⅝-inch liner carrying 801 feet of perforated.

The Union Oil Co. added its second well to its list of producers in the Playa Del Rey Field bringing in No. 3 Townsite flowing 365 bbls. per day from the Del Rey zone at 4,890 feet, the hole having been finished with an 8⅝-inch oil string carrying 991 feet of perforated. The Black Gold Petroleum Co.'s No. 1 Del Rey finished in the Del Rey zone at 4,695 feet, was good for 640 bbls. per day upon completion, the oil testing 23.4 degrees and showing a cut of 1 per cent. The Nelson Petroleum Co. finished its second well in the Del Rey zone this week when No. 3 Venice, a new well, was brought in flowing 628 bbls. upon completion at 4,431 feet, the oil testing 23.3 degrees. The California Northern Corp. failed to secure a natural flow in No. 2 Lindblade upon completion in the Recreation zone at 6,389 feet but this well responded to artificial stimulation and is at the present time doing 190 bbls. of clean 23.6 gravity oil per day on a compressor. The Getty Oil Co. also failed to secure a natural flow in a new well finished this week but this project, No. 6 Venice, was completed on the beam pumping 404 bbls. of clean 24.1 gravity oil per day from 4,418 feet, the hole having been finished with a 6⅝-inch liner carrying 902 feet of perforated. John DeMaria, Jr., successfully finished his No. 1 Venice but this new well, bottomed at 6,251 feet and finished with a 4¾-inch liner including 219 feet of perforated, was only good for 210 bbls. per day on the beam. The Jergins Trust also found it necessary to put a well on the pump this week in order to secure production but this project, No. 1 Moore, a new well, was a commercial producer as it was good for 526 bbls. of 23.5 gravity oil per day from 4,600 feet. C. E. Lewis' No. 3 Wolfe, a new well finished in the Del Rey zone at 4,153 feet, came in under a natural flow during the latter part of the week flowing 630 bbls. of 23.4 gravity oil per day.

Ventura Avenue

The Shell Oil Co. finished a nice well in the Ventura Avenue Field during the early part of the week and this new producer, No. 51 Taylor, bottomed at 6,934

TANKER SHIPMENTS FROM LOS ANGELES TO ATLANTIC AND GULF COAST PORTS

Commodity—	Total this week	Daily average	Total last week	Daily average	This year to date	Same time last year
Crude oil	.....	.....	.....	.....	68,690	997,250
Fuel oil	.....	.....	.....	.....	71,950	457,175
Diesel and gas oil	179,792	25,685	43,290	6,184	3,034,162	2,299,684
Gasoline	327,013	46,716	294,420	42,060	16,645,237	17,285,496
Kerosene	.....	.....	.....	.....	.....	49,750
Naphtha distillate	.....	.....	.....	.....	.....	81,750
Coastwise—						
Crude oil	366,431	52,347	313,601	44,800	13,465,045	23,105,192
Fuel oil	291,360	41,623	423,566	60,509	15,064,323	16,523,741
Diesel and gas oil	36,059	5,123	37,674	5,382	1,440,688	1,042,689
Gasoline	244,821	34,971	205,046	29,292	10,635,780	9,347,273
Kerosene	.....	.....	2,180	311	151,436	69,987
Exports—						
Crude oil	141,419	20,203	173,767	24,824	5,843,670	5,009,820
Fuel oil	151,621	21,770	319,639	45,663	14,993,964	15,471,075
Diesel and gas oil	6,010	859	51,322	7,317	3,866,676	2,275,455
Gasoline	229,271	32,753	381,419	54,488	13,792,649	10,243,977
Kerosene	.....	.....	.....	.....	3,085,709	2,706,565
Lubricants	.....	.....	.....	.....	27,434	.....

TANKER SHIPMENTS FROM SAN FRANCISCO TO ATLANTIC AND GULF COAST PORTS

Diesel and gas oil	.....	.....	.....	.....	279,088	.....
Gasoline	.....	.....	71,914	10,273	1,080,671	2,051,043
Lubricants	.....	.....	3,022	432	27,796	138,706
Coastwise—						
Fuel oil	3,580	511	.....	.....	2,750,552	2,692,971
Diesel and gas oil	.....	.....	.....	.....	310,222	360,538
Gasoline	59,210	8,459	30,129	4,304	3,721,276	4,285,933
Kerosene	.....	.....	4,614	659	194,883	186,796
Exports—						
Crude oil	.....	.....	.....	.....	59,993	121,603
Fuel oil	.....	.....	56,980	8,140	866,296	778,606
Diesel and gas oil	.....	.....	.....	.....	457,589	326,657
Gasoline	164,650	23,521	.....	.....	3,571,126	4,795,361
Kerosene	13,101	1,872	.....	.....	570,271	528,060
Lubricants	.....	.....	.....	.....	33,579	29,795

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feet and finished with a 6⅝-inch oil string, is flowing 1,780 bbls. of clean 30.1 gravity oil per day. Judging by the present status of development work in the Ventura Avenue Field, we may anticipate the completion of about 10 wells within the next 60 days. About half of this number should be tanking oil before the close of the current year but it is not likely that they will be bunched to such an extent that their completion will cause field production to exceed the allotment given this field. The Associated and Shell have been endeavoring to keep their respective production within the allowable quota established by Umpire Grimm and drilling operations in this field are predicated on the basis of merely maintaining current production. The Barnsdall and Rio Grande failed to secure a natural flow in No. 7 Doty, finished at 3,447 feet, and preparations are being made to put this well on a compressor in the hope of finishing the next well in the Elwood Field of Santa Barbara County. During the early part of the current week the Elwood Exploration Co. completed well No. 5 on tideland permit No. 90 and although this new well failed to come in under a natural flow upon completion at 3,522 feet it was good for 965 bbls. of 30.6 gravity oil per day on a compressor. This is the fortieth successful completion to be listed in the Elwood Field since completion of the Barnsdall and Rio Grande's discovery well, No. 1 Luton Bell.

Midway-Sunset

Drilling operations in the Midway-Sunset Field of Kern County have shown a decided decline during the past few months due to the completion of development work out in the Maricopa Flats section and it appears quite probable that drilling will be reduced to a minimum during the next several months, especially since this field will be required to effect an additional curtailment in production to offset some of the new production anticipated at Kettleman Hills and Lost Hills-Belridge. Drilling operations in the Mount Poso and Round Mountain Fields are also at a low ebb and it is quite likely that development work in these two fields will also be reduced for the next several months. In the Round Mountain Field the Shell Oil Co. concluded drilling operations on two new wells, both of which registered commercial production. No. 14 Jewett, bottomed at 2,695 feet, was good for 172 bbls. of 23.4 gravity oil on the beam, while No. 9 Freeman, finished at 1,705 feet, was good for 160 bbls. of 21.8 gravity oil per day on the pump.

J. J. Ritchie's No. 1 Tejon in Section 33-11-19, is one of the most promising wildcats under way in California at the present time, as this project has cored several streaks of good looking oil sand. The indications found up to the present time are not of sufficient importance to warrant the expectation of developing commercial production but they are, to say the least, very encouraging. This hole will bear watching as a recent core revealed the existence of 7 inches of oil sand interbedded in the predominating brown shale. In the Weed Patch area of Kern County where the Shell Oil Co. is attempting to open up a new field, No. 1 Porter Day is rotating ahead at 5,990 feet. It is the general consensus of opinion that No. 1 Porter Day is an edge well located on one extremity of a probable new field. This theory is confirmed by the preliminary production test conducted several weeks ago, at which time the well showed evidence of resulting in production. Water trouble prevented the production of clean oil, however, with the result that the Shell subsequently decided to explore ahead.

The Richfield Oil Co.'s No. 1 Belridge in Section 22-27-20, located approximately 1 mile northwest of the Belridge Oil Co.'s No. 15, which recently proved up the existence of Temblor production in the Belridge Field of Kern County, is not looking any too promising from a production standpoint, although its status may change at any time. This well, which is already deeper than the Belridge Oil Co.'s deep zone discovery, encountered the top of the Temblor and, while some gas is in evidence, it is not showing the kick which it should have if it is to duplicate the performance of the initial producer. The Belridge Oil Co.'s deep zone discovery well is still holding up in good shape, current production approximating 3,020 bbls. of 45.3 gravity oil and 66,000,000 feet of natural gas per day. On the basis of work undertaken up to the present itme, four additional wells should be headed down in search of Temblor production in this area within the next 15 days and, although operators are endeavoring to formulate a definite drilling program which will eliminate competitive drilling and reduce the number of drilling wells to a minimum, several additional projects are scheduled to get under way shortly. The extent and productivity of Temblor production in the North Belridge Field is at the present time conjectural and will probably not be known for several months, although the present status of the Richfield Oil Co.'s drilling project tends to indicate that the productive limits will be considerably smaller than anticipated. The upper sand in this field is extremely limited in scope and if the productive Temblor conforms with this horizon it will not prove to be as an important a factor as generally believed.

GAS WELL AND TWO OIL WELLS IN ISABELLA COUNTY, MICHIGAN

By Paul A. Elliott

MUSKEGON, Mich., Nov. 10.—A new 2,000,000-foot gasser that extended the Broomfield Township gas area more than a mile south and west and two new oil wells, one in Chippewa and the other in Denver Township, Isabella County, were the principal new completions in Michigan fields last week.

The Rockford Oil & Gas Co.'s No. 1 G. S. Weidman estate, E half SW Section 9-14n-6w, Broomfield Township, topped the Marshall pay at 1,409 feet.

Open flow capacity of the well, which is more than a mile from three original gassers in the township brought in by the Isabella Oil Development Co. in Sections 10 and 3, was gauged at 2,114,000 feet.

The Ohio Producing & Refining Co.'s No. 2 Epple, NE NE NW Section 30-15n-3w, Denver Township, Isabella County, topped the Dundee limestone at 3,610 feet with pay at 3,644 feet. Drilling was suspended at 3,659 feet when the well was making 200 bbls.

The Mount Pleasant Oil & Gas Co.'s No. 3 Thompson-Bortz, NE NE NW Section 12-14n-3w, Chippewa Township, Isabella County, came in as a 100-bbl. producer in the Dundee. It was the one hundred eighty-fourth well in the field.

(Continued on Page 206)

IMPORTANT NORTHERN CALIFORNIA WILDCATS

Company, well, location—	S-T-R	Depth	Status
Standard, No. 1 Point Conception, Santa Barbara Co.	X- 5-34	6,594	hd. sd. drilling
Prairie Oil Co., No. 1 Lompoc, Santa Barbara Co.	15- 7-35	5,625	abandoned
Fields Gas Co., No. 1 Santa Maria, Santa Barbara Co.	8- 9-33	5,590	suspended
Western Gulf, No. 1 Santa Maria, Santa Barbara Co.	5- 9-33	4,540	sd. sh. drilling
Barnsdall, No. 1 Gato Ridge, Santa Barbara Co.	9- 8-32	5,278	sd. sh. drilling
Midwest Oil Co., No. 1 Los Alamos, Santa Barbara Co.	2- 7-33	1,502	cleaning out
General Pet., No. 1 Goleta, Santa Barbara Co.	21- 4-28	4,533	gas—shut in
General Pet., No. 2 Goleta, Santa Barbara Co.	21- 4-28	4,350	gas—shut in
General Pet., No. 3 Goleta, Santa Barbara Co.	21- 4-28	2,650	br. sh. drilling
General Pet., No. 134 Goleta, Santa Barbara Co.	21- 4-28	1,486	suspended
General Pet., No. 136 Goleta, Santa Barbara Co.	21- 4-28	1,016	suspended
General Pet., No. 137 Goleta, Santa Barbara Co.	21- 4-28	1,026	suspended
General Pet., No. 138 Goleta, Santa Barbara Co.	21- 4-28	4,931	suspended
General Pet., No. 139 Goleta, Santa Barbara Co.	21- 4-28	1,035	suspended
General Pet., No. 143 Goleta, Santa Barbara Co.	21- 4-28	1,040	suspended
Boles Oil Co., No. 140 Goleta, Santa Barbara Co.	22- 4-28	1,040	suspended
U. S. Pet., No. 141 Goleta, Santa Barbara Co.	20- 4-28	1,035	suspended
U. S. Pet. No. 142 Goleta, Santa Barbara Co.	20- 4-28	1,032	suspended
U. S. Pet., No. 143 Goleta, Santa Barbara Co.	20- 4-28	1,019	suspended
El Camino, No. 149 Goleta Tideland, Santa Barbara Co.	22- 4-28	1,035	suspended
Bolsa Chica, No. 191 Goleta, Santa Barbara Co.	24- 4-29	3,216	sd. sh. drilling
Caldwell Brown, No. 159 Goleta, Santa Barbara Co.	24- 4-29	1,040	suspended
Cochran, J. H., No. 1 Naples, Santa Barbara Co.	7- 4-29	4,078	sd. sh. drilling
Johnson, George, No. 1 Goleta, Santa Barbara Co.	X- 4-28	3,970	cleaning out
Wildcat Oil Co., No. 1 Santa Maria, Santa Barbara Co.	20-10-35	5,500	suspended
Pacific Western, No. 1 Gibraltar, Santa Barbara Co.	14- 5-27	2,345	suspended
Prairie Oil & Gas Co., No. 1 Ventura, Ventura Co.	30- 3-22	7,518	cleaning out
Rio Grande, No. 1 Lankershim, Ventura Co.	13- 4-19	1,820	cleaning out
Associated, No. 1 Rincon Creek, Ventura Co.	19- 4-24	2,080	suspended
Pure Oil Co., No. 1 S. P. Canyon, Ventura Co.	15- 4-21	2,360	cleaning out
California Republic, No. 1 Sespe, Ventura Co.	23- 4-21	rig	suspended
Superior Oil Co., No. 1 Sespe, Ventura Co.	14- 4-21	2,492	sd. sh. drilling
Lockwood Valley Oil Co., Well No. 1, Ventura Co.	32- 8-21	210	suspended
Nordon Oil Co., No. 1-A Buttonwillow, Kern Co.	7-29-24	5,095	cleaning out
Superior Oil Co., No. 1 Buttonwillow, Kern Co.	32-29-25	....	material
Federal Drlg. Co., No. 1 Buena Vista, Kern Co.	20-31-24	3,561	sd. sh. drilling
General Pet., No. 1 Belridge, Kern Co.	30-28-21	2,599	sd. sh. drilling
The Texas Company, No. 1 Belridge, Kern Co.	22-27-20	140	sd. drilling
Richfield, No. 1 Belridge, Kern Co.	20-27-20	5,475	sd. sh. drilling
Standard, No. 1 Belridge, Kern Co.	21-27-20	rig	rigging up
Ohio Oil Co., No. 1 Belridge, Kern Co.	36-27-20	rig	rigging up
Union, No. 1 Belridge, Kern Co.	27-28-20	....	location
Rio Grande, No. 1 Belridge, Kern Co.	18-28-22	3,680	suspended
Reward Oil Co., No. 1 Belridge, Kern Co.	34-27-20	rig	rigging up
Shell, No. 3 Belridge, Kern Co.	24-28-20	940	suspended
Shell, No. 4 Belridge, Kern Co.	14-28-20	460	core hole
Wallace, K. C., No. 1 Belridge, Kern Co.	32-29-21	3,810	repair rig
Rio Cal. Pet., No. 1 Shale, Kern Co.	2-27-18	2,270	cleaning out
Shell, No. 1 Weed Patch, Kern Co.	29-30-29	5,990	sd. sh. drilling
Shell, No. 2 Weed Patch, Kern Co.	29-30-29	1,516	sd. sh. drilling
Mohawk Oil Co., No. 1 Weed Patch, Kern Co.	32-30-29	1,181	sd. sh. drilling
Pet. Sec., No. 1 Edison, Kern Co.	14-29-29	3,580	redrilling
Symark Oil Co., No. 1 Edison, Kern Co.	24-29-29	2,130	suspended
Sayre, F. M., No. 1 Edison, Kern Co.	5-30-29	4,220	suspended
Standard, No. 1 Devils Den, Kern Co.	14-25-18	1,050	sd. sh. drilling
Shell, No. 1 Semitropic, Kern Co.	17-27-23	7,460	hd. sd. drilling
Moran & DeCamp, No. 1 Mojave, Kern Co	26-10-14	710	hd. sd. drilling
Meridan Oil Co., No. 1 Antelope, Kern Co.	11- 9-15	3,560	suspended
Bardeen, H. A., No. 1 San Emidio, Kern Co.	18-10-23	1,190	suspended
Bardeen, H. A., No. 2 San Emidio, Kern Co.	10-10-23	4,177	cemented
Ritchie, J. J., No. 1 Tejon, Kern Co.	33-11-19	4,894	br. sh. drilling
Associated, No. 1 Jacalitos, Fresno Co.	22-21-15	2,113	sd. sh. drilling
Petroleum Securities, No. 3 Huron, Fresno Co.	28-20-16	....	location
Carruthers Oil Co., No. 1 Fresno, Fresno Co.	4-17-20	rig	rigging up
Panorama Oil Co., Well No. 1, San Luis Obispo Co.	7-31-21	4,019	suspended
Latin Amer. Pet., No. 1 Shandon, San Luis Obispo Co.	22-27-15	4,525	suspended
Paso Robles Synd., No. 1 Creston, San Luis Obispo Co.	21-27-11	3,941	suspended
Continental, No. 1 San Miguel, San Luis Obispo Co.	26-25-11	620	sd. sh. drilling
Schilling, C., No. 1 Atascardero, San Luis Obispo Co.	24-28-12	880	suspended
Pismo Dome Oil Co., No. 1 Edna, San Luis Obispo Co.	5-31-13	3,010	suspended
Firemans Pet., No. 1 Pismo, San Luis Obispo Co.	13-32-13	rig	rigging up
Standard, No. 1 King City, Monterey Co.	23-22- 7	5,740	gr. sd. drilling
Brown, F. A., No. 1 Parkfield, Monterey Co.	15-23-14	816	suspended
O'Donnell, J. E., No. 1 Dudley Ridge, Kings Co.	7-23-20	1,635	gas well—idle
Murphy Oil Co., No. 1 Dudley Ridge, Kings Co.	20-22-20	580	sd. sh. drilling
Friend & Fiske, No. 1 Tulare Lake, Kings Co.	11-23-19	1,050	cemented
Knudsen & Smith, No. 1 Reef Ridge, Kings Co.	36-23-17	mtl.	suspended
Wellport Oil Co., No. 1 Devils Den, Kings Co.	9-24-17	3,940	suspended
Twin State Oil Co., No. 1 Point Arena, Mendocino Co.	14-12-17	4,950	sd. sh. drilling
Orinda Pet., Well No. 1, Contra Costa Co.	32- 1- 3	732	hd. sd. drilling
White, Roy, No. 1 Pixley, Tulare Co.	8-23-26	4,495	suspended
Campbell Oil Co., No. 1 Porterville, Tulare Co.	22-22-27	857	suspended
Terra Bella Oil Co., No. 1 Porterville, Tulare Co.	35-22-27	918	suspended
Western Oil Co., No. 1 Porterville, Tulare Co.	35-22-27	1,022	cleaning out
Mills & Wilson, No. 1 Porterville, Tulare Co.	35-22-27	913	testing
Cummings Pet., No. 1 Porterville, Tulare Co.	27-22-27	1,296	abandoned
Jennings Synd., No. 1 Porterville, Tulare Co.	8-23-28	510	suspended
Terra Bella Drlg. Co., No. 2 Porterville, Tulare Co.	34-22-27	920	recemented
Terra Bella Drlg. Co., No. 3 Porterville, Tulare Co.	23-22-27	696	abandoned
Jaques Oil Co., No. 1 Porterville, Tulare Co.	34-22-27	914	suspended
Rayatt Oil Co., No. 1 Porterville, Tulare Co.	34-22-27	1,090	abandoned
Hallock, William, No. 1 Porterville, Tulare Co.	34-22-27	1,090	suspended
Kern Pet. Co., No. 1 Porterville, Tulare Co.	34-22-27	1,184	suspended
Miller & Sylvan, No. 1 Porterville, Tulare Co.	11-23-27	810	sd. sh. drilling
Larson Oil Co., No. 1 Porterville, Tulare Co.	11-23-27	1,160	reaming
Larson Oil Co., No. 2 Porterville, Tulare Co.	11-23-27	124	suspended
Kettleman Trust, No. 1 Porterville, Tulare Co.	21-22-27	940	sd. sh. drilling
Lewis, Paul M., No. 1 Porterville, Tulare Co.	15-22-27	1,118	plug to 730
Turk & Campbell, No. 1 Porterville, Tulare Co.	34-22-27	1,352	sd. sh. drilling
Roetner Oil Co., No. 1 Porterville, Tulare Co.	34-22-27	1,151	sd. sh. drilling
Wells & Armstrong, No. 1 Porterville, Tulare Co.	10-22-27	210	suspended
Enterprise Oil Co., No. 1 Porterville, Tulare Co.	29-23-28	590	hd. sd. drilling
Colusa Oil Co., No. 1 Bush, Colusa Co.	31-15- 4	761	hd. sd. drilling
Getty Oil Co., No. 1 Nigger Heaven, Yolo Co.	23-12- 3	2,050	suspended

IMPORTANT SOUTHERN CALIFORNIA WILDCATS

Union, No. 1 Orchard Dale, Los Angeles Co.	10- 3-11	5,640	sd. sh. drilling
Olympic Realty Corp., No. 1 Venice, Los Angeles Co.	14- 2-15	4,470	br. sh. drilling
Dwyer & Becker, No. 1 Compton, Los Angeles Co.	17- 3-13	4,520	cleaning out
Francis, Don, No. 1 Compton, Los Angeles Co.	8- 3-13	572	suspended
Central Oil Co., No. 1 Compton, Los Angeles Co.	28- 3-13	5,094	suspended
Combs, E., No. 1 Compton, Los Angeles Co.	16- 3-13	692	cleaning out
Cal. Ventura Oil Co., No. 1 Manhattan, Los Angeles Co.	30- 3-14	6,525	suspended
Cal. Ventura Oil Co., No. 1 Hermosa, Los Angeles Co.	31- 3-14	3,396	cleaning out
Cal. Ventura Oil Co., No. 2 Hermosa, Los Angeles Co.	31- 3-14	3,580	sd. sh. drilling
Cal. Ventura Oil Co., No. 3 Hermosa, Los Angeles Co.	31- 3-14	....	material
Westwood Pet., No. 1 Hermosa, Los Angeles Co.	6- 4-14	....	material
McMahon & McDonald, No. 1 Watts, Los Angeles Co.	12- 3-14	4,666	suspended
McKeon Drlg. Co., No. 1 Watts, Los Angeles Co.	1- 3-14	300	suspended
Rio Grande Oil Co., No. 1 Watson, Los Angeles Co.	17- 4-13	6,295	suspended
Tenacity Oil Co., No. 1 Dominguez, Los Angeles Co.	11- 4-13	8,580	suspended
Shell, No. 1 Van Nuys, Los Angeles Co.	19- 2-15	5,647	hd. sd. drilling
San-Van Oil Co., No. 1 Van Nuys, Los Angeles Co.	14- 1-16	....	material
Rio Hondo Pet., No. 1 Puente, Los Angeles Co.	14- 2-10	3,726	cleaning out
Rucker & Smith, No. 2 Puente, Los Angeles Co.	27- 2-10	rig	rigging up
Barneen Pet., No. 2 Puente, Los Angeles Co.	2- 2-10	rig	rigging up
Bidart Oil Co., No. 1 Puente, Los Angeles Co.	15- 2-10	3,270	hd. sd. drilling
Keck & Hall, No. 1 Puente, Los Angeles Co.	22- 2- 8	1,120	gas—shut in
Marcel Pet. Co., No. 1 Puente, Los Angeles Co.	31- 2- 8	3,100	br. sh. drilling
Cudahy Oil Co., No. 1 Bell, Los Angeles Co.	30- 2-12	rig	portable equip.
Celtic Oil Co., No. 1 Monterey Park, Los Angeles Co.	25- 1-12	5,278	suspended
Los Gatos Oil Co., No. 1 El Monte, Los Angeles Co.	16- 1-11	2,215	sd. sh. drilling
Olympic Corp., No. 1 Calabasas, Los Angeles Co.	18- 1-17	5,695	fishing
Union, No. 1 Coyote Sansinena, Los Angeles Co.	30- 2-10	5,200	testing
Lamona Oil Co., No. 1 Pomona, Los Angeles Co.	34- 1- 9	980	hd. sd. drilling
Graham & Loftus, No. 1 Coyote, Orange Co.	18- 3- 9	6,733	testing
Nesa Pet., No. 1 Newport, Orange Co.	21- 6-10	4,910	suspended
Hall, H. L., No. 1 Newport, Orange Co.	20- 6-10	790	suspended
Standard, No. 1 Newport, Orange Co.	26- 6-10	2,688	hd. sd. drilling
Fidelity Pet. Co., No. 1-A Murrietta, Riverside Co.	23- 7- 3	1,010	suspended
Hemet Pet. Co., No. 1 Ward, Riverside Co.	9- 5- 1	3,560	suspended
Imperial Valley Oil Co., No. 1 Brawley, Imperial Co.	36-11-10	3,240	suspended
McGregor Synd., No. 1 Del Mar, San Diego Co.	17-14- 3	1,265	suspended
Borderland Oil Co., No. 1 Encinitas, San Diego Co.	12-13- 4	2,519	suspended
Borderland Oil Co., No. 1 Point Loma, San Diego Co.	30-16- 3	4,164	gr. sd. drilling
Carr, O. K., No. 1 Capistrano, Orange Co.	13- 8- 8	4,764	hd. sd. drilling
Grey, H. H., No. 1 Redlands, San Bernardino Co.	25- 1- 2	2,392	hd. sd. drilling
Girard & Grimes, No. 1 Corona, San Bernardino Co.	8- 2- 8	1,549	suspended
Western Gulf, No. 1 Santa Ana, Orange Co.	12- 3- 8	854	sd. sh. drilling

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Determination of Evaporation Losses

Vapor Pressure Method Developed at Whiting for Detection of Comparatively Small Percentage Losses

By George W. Chenicek and Walter G. Whitman
Standard Oil Co. (Indiana), Whiting, Ind.*

ACCURATE AND CONVENIENT METHOD

An accurate and convenient method for determining the magnitude of evaporation losses is required as a basis for further reducing excessive losses incurred in the handling and storage of oil. This paper, after reviewing the various published methods, presents the application of the vapor pressure determination developed at Whiting, to the detection of comparatively small percentage losses.

The vapor pressure method combines satisfactory accuracy with widespread applicability. Evaporation losses as low as 0.05 per cent can be detected by the decrease in vapor pressure of the gasoline, and the amount of loss is established directly by the experimental method. Samples may be collected from distant points and forwarded to a central laboratory, thus dispensing with elaborate field tests and equipment.

Illustrations of its application in standing storage tests show 0.25 per cent per month loss from gasoline in large unprotected tanks and only 0.03 per cent per month from tanks protected by breather bags. These figures confirm earlier findings by this laboratory. On displacement tests it indicates an evaporation loss of 0.05 per cent for rapid filling with a standard roof and of 0.004 per cent with a floating roof. Losses other than by evaporation are, of course, not determined in this method.

Experience with this method for over a year has demonstrated its convenience and reliability for the solution of a variety of problems in conservation.

The past few years have witnessed a growing appreciation of the losses encountered in storing and handling volatile hydrocarbons and an increasing use of equipment designed to reduce such losses. It is evident, however, that excessive evaporation is still occurring, and that the use of preventive measures is yet in its infancy, particularly in the distribution of finished products.

The first requirement of any program for conservation is a means for determining the magnitude of the losses with accuracy. Until a reasonably exact figure on how much can be saved is available, the economic problem of balancing savings against cost of equipment and operation is uncertain and a proper conservation policy cannot be defined. This paper presents a method of determining losses now employed at Whiting, giving illustrations which indicate its accuracy and its applicability to almost any type of problem involving evaporation.

Methods for Determining Loss

The methods which have been employed for measuring evaporation loss may be classed in three groups.

1. Measurement of the amount of stock before and after loss has occurred. This is usually accomplished by gauging for volumes and correcting for temperature.

2. Measurement of the actual loss by determining both the volume of vapors which escape from the system and the concentration of hydrocarbons in them.

3. Determinations of some property of the oil which changes as evaporation takes place. Gravity, distillation and vapor pressure are examples of such properties.

Gauging Method

Under ideal conditions, the amount of evaporation can be obtained with good accuracy by measurements of the volume of oil before and after loss has been incurred. The only important case approximating the ideal is standing storage where no transfer of stock is necessary during the test. The actual amount in the tank can be gauged satisfactorily, especially if a hook gauge and micrometer be employed, and the volume computed after suitable strapping of the tank and allowance for deadwood. Warping of the tank bottom or movement of the gauge hatch during the test would introduce error. The probable accuracy of tank gauges has been discussed by Wiggins and others, who point out other difficulties, especially with crude tankage.

Correction for temperature is probably the most difficult feature of the gauging method. The expansion of gasoline is about 0.06 per cent for 1° F., so that corrections to a base temperature for comparisons require better than 1° F. accuracy in the determination of temperature for the study of small losses. Since the temperatures throughout a full storage tank may easily vary over a range of 5° F., the difficulties of securing a true average are apparent. Usually the average is computed from temperatures taken at different levels in one vertical line, but this practice is questionable.

When some of the difficulties of accurate gauging in a single tank under test conditions are thus apparent, it is not surprising that the routine gauges taken throughout the refinery and the producing, transportation and sales departments should be totally inadequate for accurate estimates of losses in the intervening operations. The transfer of stock increases the possibilities of error in estimating evaporation, as for example by leakage and spillage or by a difference in oil retained in the transfer lines. In problems involving transfer of stock, therefore, the gauge method is generally recognized as unsatisfactory in practice, however suitable it might be in theory.

Measurement of Vapor Loss

Losses from a tank or other container can be measured directly by determining the volume of vapors escaping and analyzing these vapors or suitable samples for hydrocarbon content. The volume can be obtained by several means, such as a dry meter, an orifice, or a calibrated

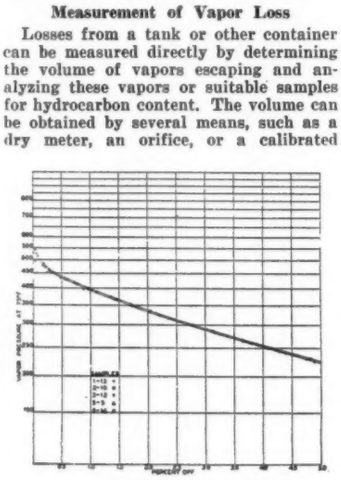


Figure 1—Protected storage loss.

breather bag. For the special case of loss measurement during rapid filling with ordinary gasoline, figures can be roughly estimated by merely assuming the gas displaced to be equal to the volume of liquid introduced.

Several analytical methods have been used on the vapors, the most common being absorption in mineral seal oil or charcoal and condensation with carbon dioxide and ether. The results by the different methods will vary, as is well recognized from experience in estimating the gasoline content of natural gas. Specific gravities of the vapors can be employed as a quick method if the relation between gravity and hydrocarbon content for a given gasoline is established independently. The best results would undoubtedly be achieved by fractional analysis of the vapor, but the technique of the analysis is too slow to employ it for a large number of samples.

The accuracy of loss measurements by this method depends chiefly upon the significance of the vapor analysis. If this is known, very good results are attainable. The method is particularly adapted to the study of filling losses where the test can be carried out near the refinery.

The limitations arise from the necessities of setting up test equipment at the tank, ensuring that vapors escape only through the metering device, and collecting vapor samples for analysis. It is, therefore, not very practicable for field work away from the laboratory or for evaporation losses in a system which is not vapor-tight.

Methods Based Upon Properties of the Oil

The several methods which determine evaporation loss by the change in some property of the oil share a common advantage of wide applicability. If evaporation can be determined by examination of a sample, it becomes possible to dispense with elaborate field equipment and technique and to extend the investigation to any point where samples can be obtained. Precautions in sampling and in avoiding or correcting for contamination are, of course, necessary; but these can be taken without undue difficulty. Some methods, therefore, permit and encourage investigations which are not practicable by other means.

The specific gravity of the stock has frequently been taken as a measure of the loss. If gravities are determined by the pycnometer, with careful technique, they are fairly sensitive to evaporation effects. However, it is necessary to determine by independent experiment the effect of loss on gravity for the particular stock under investigation. For ordinary gasoline this will run around 1° A.P.I. change for an evaporation of from 2.5 to 3 per cent.

The use of specific gravities of small cuts distilled with fractionation represents an improvement over the gravity method. The results are plotted as gravity vs. percentage distilled both for the original and final oil, the percentage distilled in the latter case being corrected to the basis of the original oil. The horizontal distance between the two curves is then taken as the evaporation loss incurred by the oil. This manner of plotting is similar to that illustrated later in the vapor pressure work.

Gravity Method

The gravity method used in this way has given good results where large losses were involved. It does not appear promising for the detection of small losses, chiefly because of the difficulties in obtaining complete condensation of light fractions, such as propane and butanes, and in making subsequent gravity determinations upon them. Further, it assumes that the various hydrocarbons evaporate from a tank in the same relative proportions as when they are distilled with fractionation, an assumption which is probably permissible in rough work, but which is hardly valid if a high degree of accuracy is required. The chief handicaps of the method appear to be unsatisfactory accuracy for the rather extensive laboratory work demanded. Distillation curves have been analyzed in conjunction with gravities as described above, but the results do not warrant expecting any greater accuracy from them.

Vapor Pressure Method

The vapor pressure of a gasoline is a property which is quite sensitive to evaporation loss, since the light components which evaporate are the same ones which are responsible for the vapor pressure. Several reliable methods of determining vapor pressure are in present use, such as the Reid bomb and the methods devised at the United States Bureau of Standards, at the Humble Oil & Refining Co., and at this laboratory. For studies of evaporation loss the first two have the disadvantage that only one vapor pressure is known for a sample at any one temperature. This requires that the relation between vapor pressure and loss be determined independently by experiment for any sample under investigation before the vapor pressure data can be interpreted in terms of evaporation loss. The Bureau of Standards method suffers the further disadvantage that the sample is degassed before the vapor pressure is taken, a feature which probably renders it useless for accurate studies of present commercial gasolines. The Humble method establishes a curve of vapor pressure vs. per cent evaporated; but, as described, the curve cannot be carried far enough without excessive time consumption to avoid the necessity for a separate study of vapor pressure vs. loss on each type of stock under investigation.

One of the objects of devising a vapor pressure method at Whiting was to investigate its utility in the study of evaporation losses. Accordingly the apparatus and technique were so planned that vapor pressures could be determined conveniently for any one sample with different percentage evaporated therefrom. This evaporation occurs with air at ordinary tem-

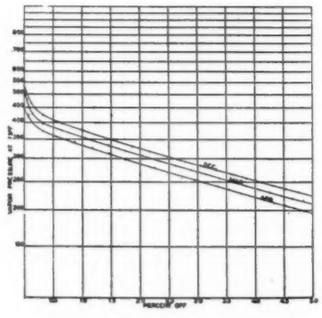


Figure 2—Unprotected storage loss.

peratures, and the vapors should, therefore, approximate in composition those evaporated from the same type of stock in the field. The effect of evaporation loss on vapor pressure for the particular

(Continued on Page 263)

*Presented at eleventh annual meeting, American Petroleum Institute, at Chicago, November 12, 1930.

One Mile Extension to Noodle Creek

New Well Lessens Distance to Tiner Pool. Surveying for Gas Line, Big Lake to San Angelo. Extend Winkler Proration

By L. E. Bredberg
Fort Worth Bureau, The Oil and Gas Journal

FORT WORTH, Tex., Nov. 10.—The Noodle Creek Pool of Jones County was extended almost 1 mile to the northwest toward the Tiner Pool by C. R. Pope's No. 1 W. D. Swan, in the SE cor. of the I. Miley Survey No. 281, which looks good for about 10 bbls. per hour from pays picked up at 2,516-17 feet and 2,534-35 feet. Total depth of the extension well is 2,542 feet. This is one of the first wells to be drilled and produced in this area for several months, and making an extension well may bring renewed activity to the area, although pipe line connections may be rather difficult to obtain from purchasing companies serving the two nearby pools.

Magnolia Petroleum Co.'s No. 1 George Sealy, in the NE of Section 46, Block F, G.M.M.B.&A. Survey, Ward County, about 4 miles west of the Gulf Production Co.'s O'Brien producers, is making but a small amount of oil per day with an estimated 3,000,000 feet of gas, thereby limiting the O'Brien Pool in that direction but apparently proving the intervening acreage good for production, although some of the acreage may produce but small wells. It first had a slight show of oil at 2,794-2,890 feet, and an estimated 500,000 feet of gas from 3,012-14 feet. It was shot with 30 quarts from 3,035-44 feet, but was not benefited by the shot, and failed to make a commercial producer.

Cranfill Brothers and Gulf Production Co.'s No. 1 Tubb in Section 8, Block B-27, western Crane County, a wildcat discovery 18 miles west of the Church-Fields and McElroy Pools, is still fishing at 4,488 feet with two strings of tools in the hole. This test topped a deep pay at 4,295 feet and flowed 100 bbls. in five minutes, making only 1,051 bbls. on a 24-hour test when drilled to 4,304 feet.

Cranfill Brothers and Atlantic Oil Producing Co.'s No. 1 Muir, another test drilling in this area, 2 miles to the south, is shut down for 6⅝-inch casing at 3,712 feet. It has been flowing sulphur water from 3,695-3,712 feet, but as in the case of the Tubb well this water is to be cased off and drilling resumed to test the pay found in the aforementioned well, which was the first well in West Texas to tap this new pay found below the water. Water heretofore has generally been the deciding factor in abandoning wildcat tests, but from now on it will probably fail to cause plugging of a test.

In the Leck Pool, Winkler County, the Empire Gas & Fuel Co.'s No. 1-C Daugherty in Section 16, Block 74, a south offset to Atlantic Oil Producing Co. and Maxwell's late extension well of the pool, was shut down at 3,089 feet for a short time, making an estimated 10 bbls. of oil and 100 bbls. of sulphur water daily, but an increase in oil was encountered from 3,105-10 feet, although it is still making more water than oil. It will be carried to 3,130 feet before a test is made. Looks as if it might mark the southern end of the Leck Pool.

Winkler Proration Extended

Winkler County production has been cut to 60,000 bbls. per day allowable and proration extended for 90 days from November 5 when operators in the pool met at Fort Worth and discussed further proration, deciding at that time to extend it for another three months. The county has produced better than 132,500,000 bbls. of oil since its discovery, the Hendricks Pool producing about 130,500,000 bbls. of this amount, the O'Brien Pool in the southern part of the county producing 263,052 bbls., the Leck Pool, north of the Hendricks Pool, producing 1,412,703 bbls. and the Llano-Scarborough Pool in the north end of the county producing 358,621 bbls.

The daily allowable of the Hendricks Pool has been held at 80,000 bbls. up to November 5. There are 534 producing wells in the pool on 266 21/24 units.

Fuhrman Petroleum Co.'s No. 1 Ford in Section 16, Block A-43, southern Andrews County, is to be plugged back to shoot. Total depth is 4,614 feet, and sulphur water was encountered at 4,612-14 feet.

The Penn Pool, Ector County, shows an accumulated total of 2,830,011 bbls. of production up to and including October 29, 1930.

WEST TEXAS PRODUCTION
Week Ending November 8

County—	No. wells	Bbls.
Andrews	2	134
Crane	370	28,010
Crockett	49	1,740
Ector	72	6,405
Fisher	8	1,876
Garza	0	27
Howard-Glasscock	528	31,515
Irion	7	131
Jones	73	138
Loving	31	2,960
Mitchell	148	2,171
Pecos	511	109,110
Reagan	253	26,230
Runnels	3	11
Scurry	5	9
Taylor	3	111
Upton	251	7,805
Ward	44	3,805
Winkler	592	58,705
Total this week		280,893
Total last week		280,673
Increase		220

Preliminary parties of engineers and workmen are now busy on a survey and right of way for the Oklahoma Natural Gas Corp.'s 10-inch line from the Big Lake Field in Reagan County to San Angelo, and on its 8-inch line from the field to the Pecos Valley Power & Light Co.'s plant on the Pecos River between McCamey and Girvin, this company to purchase residue gas from the Big Lake Oil Co. and Group No. 1 Oil Corp. (Texon Oil & Land Co. which is a subsidiary of the Continental Oil Co.), and pipe it to San Angelo and intermediate towns for commercial and domestic use and to the Power company's plant for commercial use. The seven deep wells in the field are now capable of producing around 162,000,000 feet of sweet gas per day, a good portion of it being processed in the two casinghead gasoline plants in the field.

Big Lake Oil Co.'s No. 4-C made another peak flow of 4,059 bbls. this week. No. 1-C also established a peak for itself, making 1,431 bbls. in 24 hours. No. 4-C has 700 pounds of back pressure being applied to it while the company's No. 2-C is being held down with 900 pounds back pressure, these pressures being used to keep down oil and gas production until special alloy tubing can be run to curtail the daily output of the wells.

Adams, Ferguson and Hobbs' No. 2 Lowe, located 657 feet east of their No. 1 discovery well in Section 120, Block 19, Guadalupe County School Lands Survey, is shut down at 2,435 feet apparently a dry hole. The pay was expected to be found around 2,360 feet where about 1,000,000 feet of gas showed, but oil failed to materialize in the hole. Production in this area is coming from the King sand which does not cover but a small area in this pool, and is but a thin strata, consequently the pool is not hoped to produce many or large wells, but high gravity oil which is being transported by tank car to the Marathon Oil Co.'s refinery at Fort Worth.

COMPLETIONS IN WEST TEXAS

Crane County

Gulf Production Co.'s No. 83 McElroy, top pay 2,780 feet, initial production 820 bbls., total depth 2,983 feet. Gulf Production Co.'s No. 84 McElroy, top pay 2,778 feet, shot with 270 quarts from 2,773-2,963 feet, initial production 715 bbls., total depth 2,968 feet.

Ector County

Humble Oil & Refining Co.'s No. 11 R. L. York, top pay 3,635 feet, increase at 3,660 feet, was flowing 300 bbls. before shot, initial production after shot 1,000 bbls., total depth 3,700 feet. Landreth Production Corp.'s No. 6 University, top pay 3,490 feet, increase from 3,580-99 feet, flowing 299 bbls. per day before shot, shot with 200 quarts from 3,487-3,588 feet, initial production 348 bbls., total depth 3,599 feet.

Pecos County

Culberson Brothers' No. 1 J. H. Tippett, top pay 373 feet, initial production 155 bbls. per day, total depth 491 feet. Dixie Oil Co.'s No. 5 J. H. Tippett, top pay 415 feet, initial production 60 bbls. in 14 hours, total depth 442 feet. C. L. Dittman's No. 1 H. J. Eaton, top pay 1,574 feet, initial production 50 bbls., total depth 1,580 feet. Southern Crude Oil Purchasing Co.'s No. 8 J. H. Tippett, location abandoned. Southern Crude Oil Purchasing Co.'s No. 9 J. H. Tippett, location abandoned.

Reagan County

Big Lake Oil Co.'s No. 4-C University, top pay 8,220 feet, initial production 2,478 bbls., gauged 53,070,000 feet of gas, total depth 8,697 feet.

Upton County

Penn Oil Co. and Shell Petroleum Corp.'s No. 1 I. M. Anderson, dry and abandoned, total depth 3,730 feet.

Ward County

Tex-Oil Production Co.'s No. 1 Redman, temporarily abandoned, total depth 5,077 feet.

WILDCAT OPERATIONS IN WEST TEXAS

Week Ended November 10

Company, well, farm name, section and block—	Remarks—
ANDREWS COUNTY	
Fuhrman Pet. Corp.'s No. 1 Ford, 440 ft. from S and 2,200 ft. from W of Sec. 16, Blk. A-43, Public School Land	Flowing 125 bbls. oil per day; total depth 4,613 ft.
Deep Rock Oil Co. et al's No. 1 Kuykendall, 2,310 ft. from N and E of SW cor. Sec. 24, School Blk. A-46	Location.
Deep Rock Oil Co. et al's No. 1 King, 330 ft. from N and 2,310 ft. from E, Sec. 11, Blk. A-46	Top pay 4,335 ft.; flows every 4 days; temporarily abandoned; total depth 4,454 ft.
BREWSTER COUNTY	
Brewster Oil Co.'s No. 1 fee, 2,640 ft. S and 2,598 ft. E of NW cor. Sec. 45, Blk. G-15, G.C.&S.F. Sur.	Shut down 1,935 ft.
E. L. Chapman's No. 1 Skinner, C SW SE Sec. 100, Blk. 2, G.C.&S.F. Sur.	Shut down 1,302 ft.
Trans-Pecos Oil & Gas Co.'s No. 1 Jones, 920 ft. from N and 2,500 ft. from E of Sec. 18, Blk. G-15, G.C.& S.F. Sur.	Shut down 2,510 ft.
Van McPhail's No. 1 McIntyre, SE cor. Sec. 59, Blk. 352, 7 miles S of Alpine	Shut down 1,750 ft.
CONCHO COUNTY	
Beesley et al's No. 1 S. Waring Est., 1,320 ft. from S and E of A. T. Robinson Sur., Abst. 2,120 ft.	Spudded and shut down.
Turner et al's No. 1 Borsig, 150 ft. from S of NE cor. G. Emmig Sur. 130, 6 miles W of Paint Rock	Preparing to drill deeper.
CRANE COUNTY	
Cranfill Bros. and Gulf's No. 1 J. B. Tubb, 2,310 ft. from N and 330 ft. from E of Sec. 8, Blk. B-37, Public School Land	Fishing for tools 4,488 ft. Making estimated 7,000,000 ft. of gas and spraying.
Cranfill Bros.' No. 1 Muir, 330 ft. from N and 2,310 ft. from W, Sec. 33, Blk. B-37, Public School Land	Shut down 3,712 ft.
CROCKETT COUNTY	
Dieringer et al's No. 1 Banscorew estate, 330 ft. from N and 2,310 ft. from W of Sec. 27, Blk. HH, G.C.&S.F. Sur.	Rig up.
Doleman & Moore's No. 1 Perner, 3,135 ft. from N and 1,485 ft. from E of Sec. 36, Blk. 2, I.&G.N. Sur.	Spudded and shut down.
Magnolia Pet. Co.'s No. 2 Hoover, 2,310 ft. from S and 335 ft. from E of Sec. 2, Blk. FF, B.&B. Sur.	Swabbing and bailing 6 bbls. oil per day; total depth 2,056 ft.
Taylor-Link Oil Co.'s No. 1 Mary Bullock et al, 330 ft. from N and E of Sec. 41, T.C. Sur.	Drlg. 500 ft.
CULBERSON COUNTY	
Grisham & Hunter's No. 2 Garren, 2,475 ft. from S and 1,566 ft. from E, Sec. 20, Blk. 89, Public School Land	Shut down 1,520 ft.; show oil 1,400-15 ft.
Kornrumpt et al's No. 1 Garren, 330 ft. S and W, Sec. 15, Blk. 79, Public School Land	Drlg. 1,050 ft.
DAWSON COUNTY	
Albaugh et al's No. 1 Robinson, C NW Sec. 46, Blk. M, E.L.&R.R. Sur.	Standard rig.
ECTOR COUNTY	
C. P. Davis et al's No. 1 Hendricks, C SW Sec. 46, Blk. 42, Twp. 2s, T.&P. Sur.	Drlg. 4,760 ft.

(Continued on Page 192)

RUNS THROUGH TRUNK LINES

Company, size and location—	Bbls.
Atlantic, 10-inch, Houston	24,138
Gulf, 10-inch, Ranger	25,664
Humble, 2 and 8-inch, San Angelo	40,117
Humble, 10 and 12-inch, Station "A"	44,760
Illinois, 2 and 8-inch, Del Rio	31,201
Magnolia, 8-inch, De Leon	18,304
Pasotex, 8-inch, El Paso	11,013
Shell, 10-inch, Healdton	39,280
Shell, 10-inch, Houston	17,027
Texas, 12-inch, Houston	16,645
Total	268,143

RUNS TO WEST TEXAS REFINERIES

Amarillo Ref. Co., Pyote	None
Big Spring Ref. Co., Big Spring	1,287
Burford Ref. Co., Pecos	3,434
Bluebonnet Ref. Co., Wickett	None
Cosden Ref. Co., Big Spring	10,749
Col-Tex Ref. Co., Colorado	7,000
Great Western Ref. Co., Big Spring	2,890
Humble Oil & Ref. Co., McCamey	None
Richardson Ref. Co., Big Spring	None
Wickett Ref. Co., Wickett	175
Tonkawa Ref. Co., Pyote	605
Total	26,140

TANK CAR SHIPMENTS

Texas Pacific from Hurdle	1,547
Fox and Thorsen from Mertzon	135
Thomas-Brann from Grant City	....
Reagan County Pur. Co., from Texon	358
Orient from Hurdle	50
Southern Crude from Wickett	16,345
Midwest Ref. Co. from Hobbs	826
Total	19,261
Total daily average distribution	313,549
Total daily average production (including Lea County, N. Mex.)	321,844
Daily average to storage	8,295

Separate Proration for Sullivan Area

Panhandle Operators to Meet With That End in View. New Nominations Made in Panhandle, North and Central Texas Districts

By L. E. Bredberg
Fort Worth Bureau, The Oil and Gas Journal

FORT WORTH, Tex., Nov. 10.—All Panhandle oil operators' eyes are focused on Austin where the suit by the state attorneys to dissolve the injunction granted the Danciger Oil & Refining Co. preventing the Railroad Commission from interfering with its production of oil in the Panhandle has been started in the District Court. This suit will have a great bearing on the future of proration in the State of Texas, consequently many operators and companies operating in the rest of the State will also be closely following the case for the outcome will effect them all in one way or another in case of failure or success by the Railroad Commission to dissolve the injunction.

While the commission and operators were grooming for the legal battle at Austin the Panhandle district took a climb of 2,985 bbls. this week reaching a total of 84,350 bbls. daily, Gray County leading in the increase. Gray County also led the rest of the State in October for the largest number of completed producers, totaling 37 out of the 340 new wells added to production. However, the month showed the smallest total for the year, July leading with 438 completed producers.

Panhandle Operators to Meet

The Panhandle operators will meet at the Texas Hotel, Fort Worth, November 15, to discuss the continuance of proration in the Panhandle district, bringing up a separate proration plan for the Sullivan district on the western side of Gray County, which was opened several weeks ago by the discovery on the Sullivan farm of a 9,000-bbl. well by Cree-Hoover and others. This area is the most active in the Panhandle district at the present time with many tests being drilled on offset acreage, and several of them due for completion within a short time although they may have to be shut in for pipe line connections when completed, and being doubtful of receiving a purchaser for their production.

New Nominations

The Prairie Oil & Gas Co. made new nominations on November 7, in the Panhandle, Mexia, North and West Central Texas, North Texas being allotted 2,852 bbls. whereas it has been allowed 7,000 bbls. per day with 1,000 bbls. from the Nocona district. Eight hundred and fifty-two barrels of the new outlet will come from the Nocona district while the remainder comes from Archer, Baylor, Clay and Wichita Counties.

West Central Texas has been cut to 6,468 bbls. outlet through the Prairie lines, the Panhandle to 13,000 bbls. per day and Mexia to 2,200 bbls. per day. It is taking 4,000 bbls. of its own crude per day from the Panhandle. Prior to these new nominations it has been taking 12,000 bbls. per day. Wells to which Prairie Oil & Gas Co. lines are connected are allowed only 3 bbls. per day now in the North Texas and West Central Texas district and the Continental Oil Co. cut to 2½ bbls. per well.

It looks as if the companies were gradually cutting down their purchases in these districts little by little with the idea of eventually ceasing to purchase any of the production. Heretofore the wells have been cut to the marginal allowance of 12, then to 6 bbls. per day and now they are cut to 2½ and 3 bbls. per day.

Although the Panhandle district is producing over 80,000 bbls. per day there is no market for this amount, the actual market running less than 70,000 bbls. per day, the outlet being cut to 70,000 bbls. in order to meet the market demand, but in the Wichita Falls district it would be extremely difficult for the operators to cut the daily allowance to meet with the purchasers decreasing demands, and it looks as if they would have to cut their production to the limit set by the companies connected to their wells.

Panhandle Allowable Production

In accordance with the special order of the Railroad Commission of Texas Oil and Gas Docket No. 112, dated August 27, 1930, and temporary order dated November 1, 1930, it is hereby ordered that the amount of oil allowed to be produced daily by the operators and producers in the Panhandle district during the period November 1 to November 16 shall be the allowable production for each property as set forth in the proration schedule covering said period.

RECAPITULATION AND SUMMARIES

County—	Wells	Potential prod.	Total wells under 12 bbls.	Total prod. these wells	Total wells over 12 bbls.	Total prod. these wells	Total exempt oil	Bbls. proratable prod.	Allowable prod.
Carson	233	10,978	45	288	188	10,690	2,580	8,398	6,611
Gray	722	87,245	101	600	621	86,645	9,190	78,055	46,648
Hutchinson	959	22,557	521	3,473	438	19,084	9,035	13,522	15,528
Moore	21	903	9	88	12	815	232	671	554
Potter	1	7	1	7	0	0	7	0	7
Wheeler	44	762	26	139	18	623	378	392	568
Total	1,980	122,452	703	4,595	1,277	117,857	21,422	101,038	69,916

Total potential production 122,452
Total exempt production 21,422
Total proratable production 101,030
Total outlet 70,000

Young County Most Active

Young County continues to show the most activity and complete the majority of the wells in the Wichita Falls district each week, although many of them are always dry. Ten were completed this week, the best one yielding an initial production of 162 bbls. Seven of the 10 were dry and abandoned.

Grayson County's Second Well

Grayson County had its second small well this week in the Pottsboro Field. This well belongs to the Sherman Oil & Gas Co. and is located on the Dalton farm. It was first completed as a small gasser, but was drilled to 924 feet where 700 feet of oil rose in the hole. No. 2 Dalton of the same company was completed last week for 65 bbls. in three hours, estimated good for a 40-bbl. well at a total depth of 933 feet. Pay in the first well was found at 920-31 and 931-33 feet. It was Grayson County's first producing oil well and heightened interest in the area and county to a great extent, especially to those who have acreage on nearby leases or in the county, and who have faith in the county producing a large quantity of oil.

Van Lester's No. 1 Goodwin and Walker, on the western side of Shackelford County in the Goodwin-Walker area, is now underreaming 6-inch casing 70 feet off bottom to test the King sand which was logged from 1,932-34 feet, and from which there is 800 feet of oil in the hole. This well will prove about a mile extension to the aforementioned pool.

The Barnsdall Oil Co. completed its No. 1 Golson in the Burkett Pool, Coleman County, for an initial production of 300 bbls. per day, the Prairie Oil & Gas Co. completing its first well in the pool last week for an initial production of 304 bbls. The Barnsdall Oil Co.'s well makes the third well to be completed in the area which was extended by the Arcadia Refining Co.'s No. 1 Golson several weeks ago.

South of Goldsboro

Texas American Syndicate's No. 3 Newton, south of Goldsboro, set 2-inch tubing and the well is making 201 bbls. of oil and 2,000,000 feet of gas per day with 300 pounds back pressure, production coming from a sandy lime logged at 3,820-45 feet. This oil producer is in the midst of a gas area, and was somewhat surprising to the owners when it came in as such a good oil well. The Oklahoma Natural Gas Corp. has a gas gathering system in the Goldsboro area and is taking all of the gas production for commercial and domestic gas consumption in nearby towns, piping it as far west as San Angelo, about 70 miles.

NORTH TEXAS PRODUCTION
Week ending November 8

Panhandle District—	Bbls.
Carson County	6,910
Hutchinson County	17,995
Gray County	57,300
Moore County	1,290
Potter County	60
Wheeler County	795
Total production this week	84,350
Total production last week	80,540
Increase	3,810
Wichita Falls District—	
Archer County	14,311
Baylor County	940
Clay County	528
Cooke County	3,184
Foard County	142
Jack County	2,273
Haskell County	34
Montague County	6,216
Throckmorton County	746
Wilbarger County	16,574
Wichita County	23,315
Young County	11,513
Total production this week	79,876
Total production last week	80,165
Decrease	289
Ranger District—	
Brown County	5,462
Callahan County	2,955
Coleman County	2,620
Comanche County	1,101
Palo Pinto County	501
Eastland County	4,377
Shackelford County	5,567
Stephens County	5,341
Total production this week	27,924
Total production last week	28,002
Decrease	78

WILDCAT OPERATIONS IN TEXAS PANHANDLE

Week Ending November 10

CARSON COUNTY

Company, well, farm name, section and block—	Remarks
Empire G. & F. Co.'s No. 1 Jordan et al, C SE, Sec. 94, Blk. 4, I.&G.N. Sur.	Drlg. 1,690 ft.
Empire G. & F. Co.'s No. 1 Simms, 2,310 ft. N, 990 ft. E, N½, Sec. 12, Blk. 7, I.&G.N. Sur.	Drlg. 2,610 ft.
Gibson Oil Corp.'s No. 1 Foster & Co., C NW, Sec. 24, Blk. 7, I.&G.N. Sur.	Drlg. 450 ft.
Plains Holding Co.'s No. 1 McConnell, C NW, Sec. 45, Blk. 4, I.&G.N. Sur.	Drlg. 2,015 ft.
Krebs & Barnard's No. 1 Barnard, 660 ft. S and W, NW, Sec. 24, Blk. 4, I.&G.N. Sur.	S.D. 800 ft.
Lone Star Gas Co.'s No. 1 McConnell, C SE SW, Sec. 65, Blk. 4, I.&G.N. Sur.	Star machine.
Magnolia Pet. Co.'s No. 1 Burnett, 330 ft. N and W, W½ NW, Sec. 101, Blk. 4, I.&G.N. Sur.	Spudded.
Plains Holding Co.'s No. 2 McConnell, C S½ NE, Sec. 46, Blk. 4, I.&G.N. Sur.	Location.
Plains Holding Co.'s No. 3 McConnell, N½ NW, Sec. 46, Blk. 4, I.&G.N. Sur.	Rig on ground.
North American O. & G. Co.'s No. 1 McEwen, C SE, Sec. 1, Blk. 4, I.&G.N. Sur.	Drlg. 1,880 ft.
Texas Interstate P. L. Co.'s No. 1 Burnett, C W 100 ac., SW, Sec. 84, Blk. 5, I.&G.N. Sur.	Rotary rig.

CHILDRESS COUNTY

C. L. Sloane et al's No. 1 B. P. Smith, Sec. 49, F. P. Knott lands	T.D. 5,000 ft.

COLLINGSWORTH COUNTY

Dixon et al's No. 1 Bell, 330 ft. N, 1,320 ft. W, Sec. 102, Blk. 21, H.&G.N. Sur.	Drlg. 500 ft.

GRAY COUNTY

Amalgamated German-American Oil Co.'s No. 1 Webb, 330 ft. S and W, E½ NW, Sec. 12, Blk. A-9, H.& G.N. Sur.	G.W. pay 2,912-15 ft; C.O. after 500-qt. shot; S.D. 2,915 ft.
British-American Oil Co. and Shell Pet. Corp.'s No. 1 Smith, 330 ft. S and E, NW, Sec. 138, Blk. 3, I.& G.N. Sur.	Location.
British-American and Shell Pet. Corp.'s No. 2 Richardson, 330 ft. NE W½ NE, Sec. 127, Blk. 3, I.&G.N. Sur.	Drlg. 2,970 ft.
Beck's No. 1 Sullivan, 330 ft. N and E, W½ NW, Sec. 135, Blk. 3, I.&G.N. Sur.	U.R. 8-in. csg. 1,950 ft.
Brown et al's No. 1 Duncan, 330 ft. S and E, NW, Sec. 93, Blk. 3, I.&G.N. Sur.	Drlg. 480 ft.
Cockrell-McIlroy's No. 2 Allam, 330 ft. N and W, E½ NE, Sec. 127, Blk. 3, I.&G.N. Sur.	T.P. 3,260 ft; T.D. 3,280 ft; swbd. 144 bbls. in 24 hrs.
Cockrell-McIlroy Oil Co.'s No. 1 Harbaugh, 1,263 ft. N, 330 ft. W, Lot 182, Sec. 114, Blk. 3, I.&G.N. Sur.	Standardizing 3,227 ft.
Empire G. & F. Co.'s No. 1 McCullogh, 1,320 ft. S, 886 ft. W, Sec. 153, Blk. 3, I.&G.N. Sur.	Standardizing.

(Continued on Page 194)

COMPLETIONS IN NORTH CENTRAL TEXAS

Archer County

C. B. Christie's No. 1 Hamilton, dry and abandoned, total depth 1,301 feet. Dean and Alexander's No. 1 Arnold, show oil 1,163-76 feet, initial production 14 bbls., total depth 1,176 feet. Hedrick-Camp Drilling Co.'s No. 1 Inman, dry and abandoned, total depth 753 feet. Humble Oil & Refining Co.'s No. 2 Hudson, dry and abandoned, total depth 1,414 feet. Perkins and Cullum's No. 2 Falls, dry and abandoned, total depth 1,634 feet.

Cooke County

Ray Bourland and others' No. 1 Setzes, dry and abandoned, total depth 2,003 feet. D. Atkins and others' No. 1 Daugherty, dry and abandoned, total depth 1,501 feet.

Denton County

The Texas Company and Benson Brothers' No. 1 Yeatts, dry and abandoned, total depth 1,670 feet.

Grayson County

C. E. Marshall's No. 1 Mauldin, dry and abandoned, total depth 1,002 feet.

Throckmorton County

Knox and others' No. 1 Reynolds Land & Cattle Co., oil sand 529-30 feet, initial production 8 bbls., total depth 530 feet.

Wichita County

Comac Drilling Co. and others' No. 1

(Continued on Page 87)

The Mechanics of Oil Well Pumping

Stressing of Equipment Dependent on Type of Prime Mover and Type, Location and Amount of Counterbalance

By H. E. Dralle
Westinghouse Electric & Manufacturing Co.*

ABSTRACT

Stressing of the mechanical equipment on a pumping oil well is directly dependent upon the type of prime mover and upon the type, location, and amount of counterbalance. An appreciation of these relationships is essential if most economical pumping installations are to be made.

The few simple equations and the detailed oscillographic test data and results presented bring out the significance of these theoretical relations, and furnish a basis for analytical calculations of stresses and power requirements of oil well pumping equipment.

The test data submitted comprise records taken with telemeters, tachometers, ammeters, voltmeters, and timing devices so connected to an oscillograph that instantaneous values of six variables were simultaneously recorded under various conditions of well operation. A detailed analysis of these data has resulted in the following general and definite conclusions:

1. Variable well reactions impose upon surface equipment heavy stresses that are magnified by prime movers with heavy inertias and reduced with prime movers of small inertias.

2. A rotating type of counterbalance on the crank shaft gives maximum beneficial effect.

3. The variable torque of single cylinder gas engines superimposes high peak stresses on surface equipment.

4. Gas engine driven wells are most easily counterbalanced by the analytical method.

5. Torque variations on crank shaft with change in counterbalance are slight with bandwheel drive, but the motor torque variations are definite.

6. In gear drives the best counterbalance indicates best behavior throughout the whole drive.

7. On electrically operated wells the best criterion of counterbalance is equal current peaks for the well and the counterbalance.

8. Motor wells are counterbalanced best by means of graphic ammeter, wattmeter, or tachometer.

9. Counterbalance (on geared drive) giving minimum motor heating produces best operating condition on all surface equipment.

10. Extreme overloads on motors result in higher power bills.

11. Rod stress is an insensitive indication of counterbalance.

12. Difference in time on up and down stroke of the polished rod is not a criterion of correct counterbalancing.

The attention and study given to oil well pumping in the past has been largely directed toward the performance of pumps and sucker rods, independent of their relation to surface equipment. A full knowledge, however, of oil well pumping conditions demands a study of the entire surface equipment and an appreciation of the interdependent variable factors which affect the economics of successful pumping installations.

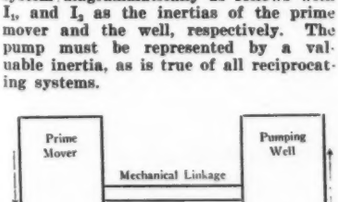
As a contribution to this study, a number of recording oscillographic tests were made to provide a basis for analytical calculations of stresses and power requirements of surface equipment and for segregating the difference in magnitude and location of stress between gas engine and motor driven wells with similar mechanical connections and varying types and amounts of counterbalance. The oscillograph was of the six-element type; and by means of it in connection with suitable telemeters, tachometers, ammeter, and slide wire were simultaneously recorded the instantaneous values of polished rod stress, polished rod travel, motor input horsepower, motor input current, motor speed, engine shaft torque, and engine cylinder pressure in definite relationships.

With the standard bandwheel set up, torques on the crankshaft show but little variation with counterbalance, whereas motor torques show very definite variations, the difference in the two being stored up energy in the system intermediate between motor crankshaft. The lower this stored up energy, the greater must be the variation in torques of the prime mover to compensate for the impulses set up by the well.

Inertia Effects Low

If only a multiple gear reduction is used between the pitman and the prime mover, the inertia effects are low; and, consequently, the impulses set up by the well must be overcome by suitable counterbalance on the slow speed side of the gear set if the gear is to be relieved of objectionable stresses in the case of engine drive and the prime mover of excessive torques to carry the well over the peaks on the upstroke in the case of motor drive. Further to clarify this last statement, it is necessary to establish the difference in performance between engine drive and motor drive.

A prime mover such as a gas engine with heavy flywheels produces much higher torsional stresses in the mechanical system between the prime mover and the well than does a motor drive with inherently lower inertias. This can be shown best by representing the pumping system diagrammatically as follows with I_1 and I_2 as the inertias of the prime mover and the well, respectively. The pump must be represented by a valuable inertia, as is true of all reciprocating systems.



Neglecting friction forces in the well and other parts of the system and the effect of flexibility in the rods, walking beam, and pitman; and assuming constant rotational speed of the crank and purely sinusoidal motion of the sucker rods, the stresses in the mechanical linkage (shown in this simple torsional system) under the influence of a sinusoidally varying torque can be shown to be:

$$\text{Stress due to } T_1 = \left(\frac{I_2}{I_1+I_2}\right)\left(\frac{1}{1-\frac{W^2}{W_c^2}}\right)$$

$$\text{Stress due to } T_2 = \left(\frac{I_1}{I_1+I_2}\right)\left(\frac{1}{1-\frac{W^2}{W_c^2}}\right)$$

Where W = frequency of the alternating torques

W_c = natural frequency of the system

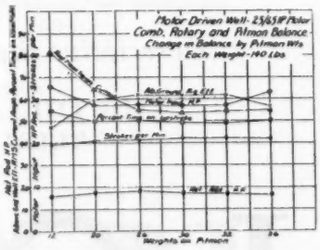
If the engine is two-cycle and running at 200 r.p.m., and the well is operating at 20 strokes per minute, the frequency of T_1 and T_2 will be 200 and 20, respectively, with harmonics 2, 3, 4, etc., times higher. The natural frequency of the system, if such system with a variable inertia at one end can be said to have a natural frequency, is about 340 per minute using the average inertia.

The factor $\frac{I_1}{I_1+I_2}$ is a very small number, so that stresses due to engine torques can never be large. Resonance can hardly become dangerous in this system because of the tremendous damping caused by well friction. In the case of well torque T_2 the factor $\frac{I_1}{I_1+I_2}$ becomes very nearly equal to 1, and so is the resonance factor; therefore, the well variable torque can cause very large torsional stresses in the mechanical linkage.

On the average sized two-speed pumping motors, such as used on heavy pumping wells, I_1 is approximately 75 pounds inches seconds.[2] This is about one-four hundred fiftieth of the gas engines used in some of these tests. In the case of the engine, therefore, $\frac{I_2}{I_1+I_2}$ becomes nearly 1. The motor drive, however, has no harmonically varying torque, i.e., T_1 equals zero and T_2 cannot cause large stresses because $\frac{I_1}{I_1+I_2}$ is now a small fraction. Thus the problem of torsional stresses, which may be very acute with an engine drive, disappears in the motor drive.

Follows Well Reactions

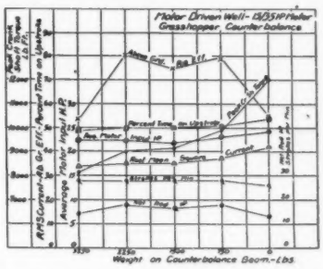
Physically, this means that the well torques are working against a stone wall with the engine drive, and in the motor drive they work against a body which can give against them. This fact is distinctly discernible by comparing any engine driven with a motor-driven well. The motor will rise and fall in speed perceptibly to follow well reactions, but a gas engine on a similar well will not visibly show appreciable speed change.


Motor Driven Well- 2½/3 HP Motor
Comb. Rotary and Pitman Balance
Change in Balance by Pitman Wts
Each Weight-140 Lbs.
Weights on Pitman

Results compiled from a series of tests.

Of course, in the motor drive the motor must supply a little extra torque to help the total inertia of the system carry the motion over the peaks; but the torques in the mechanical linkage are essentially smaller than when an engine drive is used.

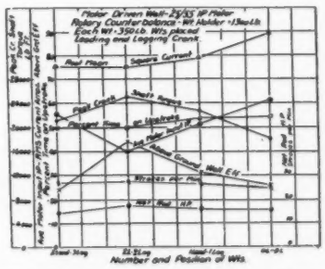
With an appreciation of these facts, it must be evident why reduction gears which will successfully pump a well using motor drive will not necessarily function without grief if a gas engine with heavy flywheels is used as the motive power. For similar reasons flywheels on high-speed pumping gear shafts impose additional stresses upon the gears, and if of sufficient size may cause gear shaft failure.



Results compiled from a series of tests with grasshopper type counterbalance.

All factors considered, most economical pumping installations seem to point to the use of gear designs which do not provide for heavy flywheels used as counterbalances on the high-speed shaft. A rotating type counterbalance on the low-speed shaft relieves the gear of these excessive stresses and permits closer design in all parts of the gear unit. From an economic standpoint, the wisdom of such applications cannot be questioned, as it is obviously cheaper to add deadweight to a counterbalance on the low-speed shaft rather than to increase gear faces, shafts sizes, beaming sizes, and other parts of the gear case to allow a similar counterbalancing effect to be placed on the high-speed shaft.

A counterbalance in the form of a flywheel on the high-speed shaft is admittedly much smaller and lighter in weight than one on the low-speed shaft to give the same counterbalancing effect. In fact, the ratio of these weights will vary inversely as the square of the gear ratio. For example, if a given counterbalancing effect is produced with a 100-pound flywheel of given dimensions on a high-speed gear shaft running at 600 r.p.m., and there is a 30 to 1 reduction between the motor and pitman, this same flywheel would be but one nine-hundredth as effective on the low-speed gear shaft.


Motor Driven Well- 2½/3 HP Motor
Rotary Counterbalance - Wt Holder -13 Lb.
Each Wt - 35 Lb. Wts placed
Leading and Lagging Crank
Number and Position of Wts.

Test results compiled from a series of tests with rotating type counterbalance.

Subjected to Two Forces

The crankshaft or low-speed gear shaft on a pumping well is subjected to two forces, one bending and one torsional,

*Presented at eleventh annual meeting, American Petroleum Institute, at Chicago, Ill., November 12, 1930.

The Dillon Company, Tulsa,

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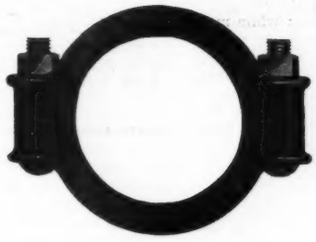

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and the two combine to produce shear. These stresses are pulsating, and are often of such magnitude as to cause shaft failure from fatigue. On any given well, both the bending and the torsional forces can be calculated from these equations:

$$\text{Bending } F_1 = W_r + W_o - W_p - \frac{b}{a} W_b - W_c + \frac{RW^2}{g} (W_r + W_o + W_p + \frac{b^2}{a^2} W_b + W_c) \cos wt$$

$$\text{Torque } T_1 = R (W_r + W_o - W_p - \frac{b}{a} W_b - W_c) \sin wt + \frac{R^2W^2}{2g} (W_r + W_o + W_p + \frac{b^2}{a^2} W_b) \sin 2wt$$

For the downstroke the forces and torques designated as F_2 and T_2, respectively, are similar in form, except W_o is omitted from the equation. Therefore, the equation need not be rewritten.

W_r = weight of rods in pounds.
W_o = weight of oil in pounds.
W_b = weight of counterweight on walking beam.
W_p = weight of counterweight on pitman.
W_c = weight of counterweight on crank.
A = length walking beam from center to pitman.
C = distance between center walking beam and counterweight on walking beam.
R = radius of crank in inches.
$W = \frac{\pi N}{30}$ where N is the number of pumping strokes per minute.

With the entire weight concentrated in the crank (rotating type counterbalance) the above expressions become:

$$F_1 = W_r + W_o - W_c + \frac{RW^2}{g} (W_r + W_o + W_c) \cos wt$$

$$T_1 = R (W_r + W_o - W_c) \sin wt + \frac{R^2W^2}{2g} (W_r + W_o) \sin 2wt$$

$$F_2 = W_r - W_c + \frac{RW^2}{g} (W_r + W_c) \cos wt$$

$$T_2 = R (W_r - W_c) \sin wt + \frac{R^2W^2}{2g} W_r \sin 2wt$$

With the counterweight all in the crank, the forces remain exactly the same as before; but the second harmonic of the torque becomes very much smaller. The entire gain of having the weight concentrated in the crank is in this fact. Where all the counterbalancing is in the crank, there is a given optimum counterweight which makes both the forces and the torques take on a minimum peak value. It is significant that stresses computed from these equations always exceeded those obtained from actual test data.

Theoretically, when counterweights are applied, they should be such that resultant stresses are kept within the limits of the mechanical drive equipment and of such a value that the motor torques do not reach excessive values on each up-stroke of the pump. With extreme loads on the motor, every stroke of the pump increases motor heating and results in inefficient operation and high power bills. Fortunately operators are not compelled to go through a series of calculations when applying mechanical drives to pumping wells. This has already been done by the designer, who makes allowances for an average set of working conditions with definite factors of safety. It remains for the operator only to counterbalance wells in an accepted manner to produce the most economical installation over-all, both from a maintenance and power standpoint.

Detailed Analyses

As a result of the detailed analyses of the test data from which the final curves were derived, the following general and definite conclusions can be drawn:

1. A rotating type counterbalance on the pitman side of the crank shaft gives maximum beneficial effect for protection of the surface equipment interposed between the prime mover and the crank.
2. Gas engines and flywheels (heavy prime mover inertias) do not allow reduction of stresses on surface equipment arising from variable well reactions. Motors (small inertias) result in considerable reduction of these stresses.
3. On single cylinder engines the variable torque delivered, due to combination of explosions and reciprocating inertias, superimposes high peak stresses on the surface equipment.
4. The analytical method of computing weight of rods and column of fluid and then taking a definite percentage of this (65 to 80 per cent) remains the simplest method of counterbalancing gas engine driven wells.
5. With band wheel drive, the torques on the low-speed shaft showed little variation with counterbalance; while motor torques showed very definite variations, the difference in the two being stored up energy in the system intermediate between motor and crankshaft.
6. With multiple reduction gears instead of the bandwheel drive, the best counterbalance would indicate the best behavior throughout the whole drive, as the motor and gear shaft torques rise and fall together.
7. On electrically operated wells, the best criterion of the counterbalance is equal current peaks to minimize motor heating. For better drives this condition does not necessarily produce minimum power consumption or minimum stress throughout the system.
8. On gear drives (multiple reduction units having the pitman directly connected to the low-speed gear shaft) the counterbalance giving the best motor heating condition will give the best operating condition on all surface equipment.
9. Rod stress is an insensitive indication of counterbalance.
10. Motor operated wells can be satisfactorily and easily counterbalanced by using a wattmeter, ammeter, or tachometer of the graphic type.
11. Extreme overloads on motors, caused by using underrated motors or insufficient counterbalance, makes them operate inefficiently; hence power bills will be higher.
12. The difference in time on the up and down strokes is not a criterion of counterbalancing. While this difference may be observable, this method is not a solution of correct counterbalance.

It is recognized that only by such observation and tests on surface equipment, correlated with those of the type made on subsurface equipment by F. W. Lake and discussed at last year's Petroleum Institute meeting, can the ultimate in economic well pumping be attained. There is still much to be done.

The writer gratefully acknowledges the assistance of M. Stone and J. Ormondroyd in securing and analyzing the data, and of W. L. Cory for completely compiling the results.

WHAT IS THE MATTER WITH THE INDUSTRY?

(Continued from Page 51)

which has been applied and the results which have been achieved have been excellent and afford hope for the future. These results have been achieved by the co-operation of State and Federal agencies with the industry; in some cases by the application of law, and, in others, merely by co-operation.

In Oklahoma an effort has been made by law not only to prevent physical waste but economic waste. In that State, economic waste as such is prohibited by law, and waste incident to the production of crude oil in excess of the market demand is declared unlawful. The Corporation Commission is given broad power to prevent waste by ascertaining the market outlet for the State as a whole, for the various producing areas of the State, and apportioning the market outlet between these areas and between the several producers of any given area. This statute has recently been subjected to attack in both the State and Federal courts of Oklahoma and has been upheld by both. These decisions are most helpful and greatly strengthen the proration movement in that State. There the Corporation Commission, upon the application of the oil producers, has ascertained the market outlet for the State to be approximately 550,000 bbls., and has apportioned this outlet to the various producing areas.

In Texas the law prohibits physical waste but specifically excludes economic waste from consideration of the Railroad Commission. It contains provisions relative to preventing discrimination and requiring purchasers to purchase ratably. The Railroad Commission is given broad powers of enforcement and under the act, upon application of the producers, has found that the market outlet for Texas is approximately 750,000 bbls. per day, and has ascertained the market outlet for each producing area of the State in order to prevent discrimination between areas and between producers in any area. This order of the commission is now under attack in the courts but no decision has as yet been announced

Last year California passed an act prohibiting the unreasonable waste of gas and setting up machinery for administering the law. This act has not yet been applied as litigation has held it in abeyance. The ground of attack is that while the State has the power to prohibit entirely the waste of gas, the effort to prohibit the unreasonable waste of gas prescribes no definite standard, and therefore, the law is void for uncertainty. Whether the attack succeeds remains to be seen. While the California statute has not yet been enforced, the producers of that State have restricted their output to approximately 600,000 bbls. per day.

The New Mexico statute permits agreements, but does not otherwise prevent production. Under this statute, the Hobbs Pool is under proration.

Enormous Burden of Stocks

As a result of the activities in these and other states, the actual production is now less than 2,400,000 bbls. and is approximately in balance with demand. However we started into the year with 682,000,000 bbls. of crude and refined oils in storage and that is approximately the figure today. This enormous quantity of storage oil and the uncertainty about proration are the immediate causes of the demoralized market for crude. The proration orders and agreements are all for short periods of time. It is probable they will be renewed, but not certain, and therefore, the overhanging potential threatens the stability of the situation and jeopardizes the price structure, notwithstanding the great good that has been accomplished.

Oil Pool a Unit

An oil pool is a unit, and obviously ought to be operated as such. Diligent efforts are being made to bring about unit operation and substantial progress is being made. This movement has, and is entitled to have, the support of the industry. It is so obviously sound that there is practically no division of opinion as to its desirability. The only differences of opinion are as to its practicability. Surface ownership does not coincide with the boundaries of the oil deposit, and therefore there are numerous surface owners entitled to penetrate the oil sands. Each one desires to recover as much of the oil as possible, and it cannot be known in advance how much is under the surface of each owner. Some surface owners need the oil in their business, while others do not, different leases have different drilling obligations. The royalty owners are an important part of the picture. This diversification of interest is an obstacle in the way of unit operation. Under the law, a surface owner has the right to drill on his own land. This is a right of which he cannot be absolutely deprived. He cannot be forced into a unit operation, and therefore unitization must rest upon consent and not compulsion. As the diversity of interest sometimes prevents consent progress in unitization can only be made gradually and by persuasion.

It cannot be regarded, therefore, as an effective remedy for existing evils, but only as an alleviation of them.

Tariff Questionable Remedy

A strong effort has been and is being made to procure a tariff on crude oil and its products. This subject is now being considered by the Tariff Commission, which will make a report to Congress in the near future. Whether a tariff will remedy the situation or improve it remains to be seen. We can only hope that if Congress imposes a tariff on imports that the result will be beneficial. The fact, however, is that during 1929 we exported 162,257,000 bbls. of crude and refined products, while we imported only 108,709,000 bbls. Our exports, therefore were approximately 54,000,000 bbls. in excess of our imports or an average of approximately 150,000 bbls. per day. The record for 1930 is about in the same proportion. If the effect of the tariff is to exclude foreign oil, it forces that oil thus excluded into foreign markets. If the effect of a tariff on wheat, as to which we have an exportable surplus, is a criterion by which to judge the effect of a tariff on oil, it will not be helpful, because while there is a tariff of 42 cents a bushel on wheat, the prices for wheat in Minneapolis and Winnipeg are approximately the same.

More Gas Wasted Than Used

It is estimated that 2,000,000,000 feet of gas are being blown into the air, of which California is wasting approximately 600,000,000 feet, Oklahoma 400,000,000, the Texas Panhandle over 500,000,000, and West Texas and New Mexico about 250,000,000. Last year the total consumption of natural gas is estimated at 1,918,000,000,000 feet, of which 360,000,000,000 feet were used by 5,116,000 domestic consumers, the rest being used for field purposes, carbon black, fuel and like purposes. The total consumption, therefore, for domestic purposes, was less than 1,000,000,000 feet per day, while the total consumption for all purposes was something over 5,000,000,000 feet per day. We are, therefore, blowing into the air twice as much gas as is being used for domestic purposes and approximately 40 per cent of the total consumption, and nearly all of this waste is occurring in three states.

Under the established law of the land, each State has the power to stop this waste, and it is well to inquire what the effect would be if the states should exercise this power.

In the first place, it would stop this terrible waste of an exhaustible and irreplaceable natural resource The average price per 1,000 feet paid by domestic consumers in 1929 was 62 cents and in the course of time, there will be a market for every foot of the gas that is now being wasted. In the next place, it would reduce the oil production. It is estimated that this gas which is being wasted is bringing to the surface more than 400,000 bbls. of oil per day. In addition, the gas which is being wasted is producing enormous quantities of natural gasoline which is not needed at this time, and which is a contributing cause to the demoralization of the industry. A reduction of 400,000 bbls. of crude per day, and a reduction of the natural gasoline output derived from the wasted gas would have an immediate effect upon the crude situation of incalculable value to the industry.

Producers Have the Remedy

This diminution of the crude supply would result in better refinery practices in order to increase the percentage of gasoline recovered and reduce the fuel oil output. The effect of this would be to avoid flooding the market with fuel oil, thereby improving the price received and benefiting both the coal industry and the railroads. It would likewise reduce the enormous stocks above ground and thus bring the industry into a better statistical position.

After a while, as the demand for crude increases, the gas which would otherwise be wasted would be returned to the oil sands for further use in the production

of crude, thus increasing the ultimate yield by a figure which is estimated by some competent observers as 20 per cent of the total. And the tendency, also, would be to discourage wildcatting, as there would be no incentive to discover new flush areas before there was a market for both the gas and oil.

Would Benefit States

It would greatly benefit the oil producing states by conserving their natural resources and encouraging industry and promoting a fair price for their products, to say nothing of the direct benefit to the State governments, by increasing their revenue which, to a large extent, is based on a percentage production tax by which these states participate in the better prices for crude. Finally, it would be a genuine conservation movement, and go far towards preventing immediate overproduction and insuring maximum ultimate recovery. Such legislation, of course, should be accompanied by ratable taking requirements, which would insure to all producers a proportionate share of the outlet for both gas and oil, and supplement, without superseding, existing statutes and the efforts now being made by the industry to correct existing evils.

For many years the governments of the oil producing states have been vitally interested in this problem and conservation legislation extends over a period of 40 years. During the past six years the Federal Oil Conservation Board has given a national impetus to the movement and has donce much towards correlating the activities of the various states and of the industry itself. Much of the fine spirit of co-operation now found amongst the oil producers is the direct result of the activities of the Federal Oil Conservation Board. But we must always bear in mind that the primary object of these public agencies is the conservation of our natural resources. They rightly believe that a genuine policy of conservation is important to the nation; they recognize that the present waste hastens the approach of the day when our oil and gas deposits will be exhausted. It cannot be too often repeated that the oil and gas resources of the nation are irreplaceable; that when they are once exhausted they are permanently exhausted, and that the nation and the states, as well as the industry, should do everything within their power to conserve them, not merely in order that those of us now engaged in the business may make a profit but that future generations may not be deprived of their use.

Over the plains area of the Southwest the Indians and the buffalo formerly found a home. The Indians would kill the buffalo as they needed them for food and clothing. Graudally the white man pushed the Indian to one side and for the sake of immediate profit, slaughtered the buffalo merely for their hides. After it was too late and the buffalo were gone, this waste was severely condemned. Over these same areas today, natural gas is being wasted and not even the hide is being saved. Shall we repeat the history of the buffalo or shall we act in time to prevent it?

WHAT IS THE OUTLOOK FOR THE OIL INDUSTRY?

(Continued from Page 48)

gas conservation law in California, the understanding and vigorous action of the Texas Railroad Commission and the Oklahoma Corporation Commission in ordering proration, indicate the growing interest of governmental agencies in seeking a solution of our large industrial problem. The significance of the recent decision of a Federal circuit court and that of the Oklahoma supreme court cannot be overemphasized. For example, this recognition by the Oklahoma court of the correlative rights of owners is of great significance:

"Surface owners of land have the right to drill for and reduce to possession the oil and gas beneath; but this right is to all of the owners alike, and, when numerous surface owners seek to produce from a common pool, it is within the police power of the State, in keeping with due process of law, to require the several surface owners to produce same under reasonable regulations to the end that some of said owners may not take from the common source more than their equitable share."

New Era Entered

The production of its raw material is basic to every industry. There can be no doubt that our production procedure, due to economic, scientific and legal factors, has definitely entered a new era. The future trend is obvious and must be truthfully and fearlessly regarded. After all, there is probably much more truth than fiction in the often repeated statement that our greatest conservation problem is the mental one.

The general restraint upon crude production which the industry has exercised is indicative of what producers can and will do to meet an emergency. Our methods of capturing oil have been, and broadly speaking still are, such as to permit the eternal existence of that overhanging shadow, "overproduction." Stability, the removal of that shadow, requires that we speedily seek and find a permanent solution. We must find an answer that will dispose permanently of the age-long methods we have employed in the competitive development of single pools. The method must be one which we may rely upon to yield economy in development and operation, to obtain greater recoveries from the sands, and to provide for stability of output as related to market demands. Without going further into the long and familiar detailed story, may I say, in brief, that I believe the answer is to be found in the application of some practicable form of unitization or unit operation. Two important sessions of this meeting are to be devoted exclusively to a discussion of this subject.

Since the organization of the three divisions—production, refining and marketing, the need on this occasion for a detailed presidential review of the status of the industry has largely disappeared. Detailed comment upon conditions prevailing in the three principal branches of the industry will be made by the vice presidents for production, refining, and marketing in their respective reports which will be made to business meetings of the divisional members on Thursday afternoon.

Three Important Factors

Critics may analyze the petroleum situation to their heart's content and find what they may seek, but as I see it these three factors in the oil situation are important for oil company ownership and management to note and to remember:

1. The petroleum industry at this moment faces a condition that it has faced only once before in its history; namely, the almost certain prospect that during the coming six months' period there will be a very small, if indeed, any percentage increase in the demand for its principal money product, gasoline.

2. The excess of all liquid petroleum products at any given time is the difference between the aggregate of all stocks actually on hand and the aggregate working stocks necessary to meet current demand. The same definition will apply to stocks of crude or of any particular refined product. It, therefore, follows that the economic lesson is to dispose of or to reduce the excess until a balance is reached.

3. The quickening of effort to find as promptly as possible, the effective and permanent solution of the industry's major problem of how to prevent recurring periods of overproduction of crude oil, which remains the root of the evil.

As suggested before, the world is staggering under the weight of surpluses of all kinds of raw material. The petroleum industry is taking the lead in restricting its output to meet the demand. It is perhaps unwise to mention increased costs at a time of great overproduction, and yet we must face the facts. Conservation, or proration, under the present plan does increase the cost of production and it will continue to increase until competitive operations are displaced by unit operations. Present prices for crude petroleum and its products are not remunerative.

In closing, may I quote from the address delivered by Charles Schwab a few days ago before the American Steel Industry, substituting the word "petroleum" for "steel":

"There are two factors entirely in the control of the petroleum industry itself, which regardless of fluctuations in general business, largely determine our success as an industry. One of these is price stability; the other is stability of production. We cannot afford to squander our resources either by price cutting below the profit line or by overproduction beyond the demand line."

PANHANDLE FIELDS

(Continued from Page 82)

Boyd, dry and abandoned, total depth 1,856 feet. Walter and Blair's No. 4 Honaker, oil sand 848-55 feet, initial production 33 bbls., total depth 855 feet.

Young County

B. C. Banner's No. 1 Finch heirs, oil sand 658-63 feet, initial production 162 bbls., total depth 663 feet. J. A. Bearman and others' No. 1 Baldwin, dry and abandoned, total depth 710 feet. Consolidated Oil Corp. of Texas' No. 1 Bailey, dry and abandoned, total depth 952 feet. W. H. Hammon's No. 1 Bullock, dry and abandoned, total depth 950 feet. R. L. Haue's No. 1 Clifton, dry and abandoned, total depth 1,002 feet. Mason and Fitzgerald's No. 1 Routon, dry and abandoned, total depth 757 feet. E. R. Riggs' No. 1-A Larimore, oil sand 689-70 feet, initial production 110 bbls., total depth 709 feet. E. J. Stump's No. 1 Jeffery, dry and abandoned total depth 1,079 feet. R. J. Watson and others' No. 1 Watson, dry and abandoned, total depth 804 feet. Atlantic Oil & Refining Co. and others' No. 1 Jarnigan, dry and abandoned, total depth 2,689 feet.

COMPLETIONS IN THE TEXAS PANHANDLE DISTRICT

Gray County

British-American Oil Co. and Shell Petroleum Corp.'s No. 1 Richardson, total depth 3,290 feet, shot with 90 quarts at 3,196-3,291 feet, and with 180 quarts from 3,168-3,283 feet, initial production 100 bbls. of oil and 60 bbls. of water. Danciger Oil & Refining Co.'s No. 1 McLaughlin, top pay 2,915 feet, initial production 122 bbls., total depth 2,921 feet. Magnolia Petroleum Co.'s No. 4 Sailor, top pay 3,185 feet, initial production 175 bbls., total depth 3,212 feet. Skelly Oil Co.'s No. 1 Vicars, top pay 2,320 feet, shot with 180 quarts from 3,233-90 feet, initial production 240 bbls. in 12 hours, total depth 3,290 feet.

Hutchinson County

Huber Petroleum Co.'s No. 1 Christian, top pay 3,006-23 feet, initial production 200 bbls., total depth 3,130 feet.

Moore County

Texas Interstate Pipe Line Co.'s No. 1 Sneed, initial production 8,000,000 feet of gas from 2,350-2,435 feet, total depth 2,564 feet. Shamrock Oil & Gas Co.'s No. 1 Coffee, top pay 3,202 feet, initial production 180 bbls. first 12 hours, total depth 3,505 feet.

COMPLETIONS IN RANGER DISTRICT

Brown County

Cox and others' No. 1 Truebeart, dry and abandoned, total depth 1,165 feet.

Callahan County

Glengary Oil Co.'s No. 1 West, dry and abandoned 1,163 feet.

Coleman County

Barnsdall Oil Co.'s No. 1 Golson, oil sand 1,587-92 feet, flowed 300 bbls. first 24 hours, total depth 1,592 feet. Prairie Oil & Gas Co.'s No. 1 Golson, oil sand 1,565-80 feet, initial production 304 bbls. flowing, total depth 1,580 feet.

Eastland County

Barkley and Cratly's No. 4 "A" Turner, temporarily abandoned, total depth 3,948 feet. Mook-Texas Oil Co.'s No. 1 Sibley, temporarily abandoned, total depth 3,620 feet. Hopkins and others' No. 1 Jones, temporarily abandoned, total depth 850 feet.

Shackelford County

Hicks and Hubbard's No. 1 Mathews, oil sand 795-803 feet, shot 2 quarts, initial production 25 bbls., total depth 803 feet. G. P. Mitcham's No. 3 Nail, dry and abandoned, total depth 1,372 feet.

Stephens County

Southern Petroleum Exploration Co.'s No. 1 Drummond, dry and abandoned, total depth 540 feet. Clements and others' No. 1 Stanley, total depth 3,960 feet, plugged back to 3,205 feet and producing 200,000 feet of gas from old pay 3,180-3,205 feet.

EARLY STABILIZATION IN GASOLINE IS SEEN

(Continued from Page 46)

refiners continued to offer it at prices ranging as low as 4⅝ cents for resale and 4¾ cents to the trade. The larger refiners who had been quoting 5¾ cents were generally quoting 5¼ to 5½ cents by the close of the week and it appeared that the market might soon be stabilized within the price range of 5 to 5¼ cents.

Natural Gasoline

All grades of natural gasoline were being firmly held at 4½ cents and it was generally understood that two major companies in the industry were ready to buy for storage at any time the price tended to go below this figure.

Kerosene and Distillates

Kerosene moved slowly with little attention being paid to prices quoted near the upper end of the price range. In some instances kerosene was being applied on distillate orders where the customer demanded an unusually high quality material and was willing to pay the top of the market for distillate. Kerosene was offered from North Texas refineries to marketers in common territory at prices which if met by Oklahoma refiners would net the latter less than 3 cents.

Fuel Oils

The lower gravity fuel oils continue to be quoted at low price levels, North Texas fuel ranging between 12 to 14 gravity and having a cold test between 40 and 50 was being offered to marketers in common territory at 25 cents to 30 cents per barrel. Some Oklahoma fuel of near that quality sold for 42½ cents per barrel. The 16 to 18 gravity Oklahoma fuel of high cold test usually sold for 42½ to 45 cents and only the zero to 10 cold test low gravity material enjoyed prices above this. Ordinarily a premium of 5 to 10 cents per barrel is placed on the respective grades of fuel when the buyer demands that the fuel have a cold test under 10° F.

Lubricants and Wax

The motor oils moved slowly and all grades were being freely offered at last week's price level. All grades of bright stocks and steam refined stocks were also freely offered, but there were no general price reductions. New low quotations were heard for steam refined stock made by Oklahoma City refiners, but these plants have been making every effort to standardize the quality of this stock and to stabilize the market and these abnormally low quotations in the past usually applied to off-brand material.

BOUGHT HONESTLY AND LEGALLY, SAYS COURT

LOS ANGELES, Calif., Nov. 11.—Federal Judge Frank H. Norcross, who heard the Government's suit to cancel leases in the Elk Hills Field of California last December, has ruled that no fraud or illegality occurred in the granting of Leases E, G and I to the Pan American Petroleum Co. in Naval Reserve No. 1. Counsel for the Richfield Oil Co. of California, which subsequently acquired the three leases in question, successfully fought the Government's action on the premise that the leases were not given as a result of fraud and conspiracy between Secretary Fall and Doheny; that they had been ratified by the action of Congress, and that on the Government's theory cancellation was a part of its former action and that the decree therein limited the Government's right of recovery because of an asserted conspiracy. Judge Norcross in ordering the dismissal of the Government's suit for cancellation ruled that the Pan American Petroleum Co. was the highest bidder for the leases acquired and that its actions were performed honestly and legally.

Pipe Line Construction News

CONTRACT AWARDED ON PENSACOLA LINE

Contract has been awarded for the construction of 36 miles of natural gas line on the Pensacola division to W. S. Bibb of Birmingham. Equipment has been moved to a point about 7 miles south of Bay Minette, and from this point Mr. Bibb has been engaged to build the line to Pensacola, Fla. The contract was awarded by the Natural Gas Engineering Corp. through L. E. Ingham, resident engineer. The total length of the line will be 74 miles, reaching from Mobile to Pensacola. The unawarded mileage will be constructed by the Natural Gas Engineering Corp. and work has begun by the latter organization on the most difficult stretch of construction which is a swamp about 14 miles long. The line will be 12¾-inch O.D. steel pipe which has been strung along the right of way. The swamp will be negotiated by sinking the pipe with heavy couplings. Added security will be provided by anchoring the line to near-by trees. It is expected that construction will be completed by December 10. Natural gas will be available for distribution by the local company in Pensacola long before the holidays. In addition to supplying the city of Pensacola with natural gas, the Southern Natural Gas Corp. has industrial contracts nearby which will provide a substantial initial load, for this latest lateral of the corporation, which new construction brings its total pipe mileage up to approximately 1,800 miles in the States of Mississippi, Alabama and Georgia.

W. S. Bibb, the contractor who has secured this work, built the line of the Southern Natural Gas Corp. from a point in the northeast of Winston County, Mississippi, to Meridian, 100 miles in 36 working days. He also built the line this summer from Atlanta, Ga., to Macon, and thence to Milledgeville with the necessary laterals.

ALBERTA LINE COMPLETED

CHATHAM, Ontario, Nov. 8.—The 6-inch pipe line to connect the Rogers-Imperial gasser in southern Alberta with the system of the Montana Cities Gas Co. is reported practically completed. The line is being laid for the Range Oil & Gas Co. of Calgary, owners of the Rogers-Imperial well, by the Turner Valley Construction Co. Approximately 7 miles of line are required to connect with the extension of the Montana Cities system at the international boundary. The Range Oil & Gas Co. will export its production under a special permit secured from the Federal Government, gas being supplied to Lewiston, Great Falls and other Montana points. With the completion of this line, a gap of only 30 miles remains between the Montana system and the main pipe line of the Canadian Western Natural Gas, Light, Heat & Power Co. at Foremost, the latter line connecting with the Turner Valley Field with its large waste gas surplus.

MOUNT PLEASANT GAS LINE

MUSKEGON, Mich., Nov. 10.—Laying of a 6-mile gas line from the Broomfield Township gas wells in the Marshall formation to the city of Mount Pleasant was said to be assured by the completion last week of the Rockford Oil & Gas Co.'s No. 1 Weidman well. The new 2,000,000-foot gasser is more than a mile from other gassers in Sections 3 and 10, Broomfield Township, and increases the potential daily flow to more than 30,000,000 feet. Right of way for a proposed line has been obtained by the Michigan Natural Gas Corp.

NORTHERN CALIFORNIA GAS LINES NOW HAVE 750-MILE NETWORK

Pacific Gas & Electric Co, it is reported, has contracted for more than 30 per cent of the total potential market for natural gas in its territory. It is estimated officially that at the current rate of progress, fully 45 per cent of the potential large-block market will have been signed up by January 1, 1931. The contracts will represent the sale of more than 13,000,000,000 feet of gas annually.

As early as 1921, Pacific Gas began investigating the possibilities of obtaining a new fuel to displace fuel oil in northern California. Not only were the possibilities of supplying natural gas studied, but also those of introducing coke ovens and water gas plants operated with coal. The company even went so far as to drill a well in a territory which experts believed contained an oil and gas reservoir. Investigations also were made of more than 100 showings of natural gas from wildcat wells drilled in northern California.

The company was approached from time to time by promoters and oil companies that proposed piping natural gas from southern California. None of those projects, however, would have enabled the company to supply natural gas in its territory at prices competitive with those of fuels already in use. Pacific Gas & Electric during that period surveyed the possibilities of all fuels used in its territory. It also estimated the amount of business that could be obtained at various prices. With such information at hand, the company determined the feasibility of any project which was presented for its consideration.

It was not until early in 1928 that sufficient natural gas was discovered in southern California to make feasible the construction of a system for its distribution. At that time, a considerable surplus of gas developed in the vicinity of the Ventura Field, and at about the same time a new field of dry gas was opened at Buttonwillow.

Even then, in order to make the project financially sound, it was planned to distribute a mixture of natural and artificial gas of a heat content of approximately 700 B.t.u.'s. The company had plans well under way to pipe natural gas from Ventura and Buttonwillow to San Francisco and vicinity, when, on October 5, 1928, the Milham Exploration Co. suddenly brought in the now famous No. 1 Elliott in the Kettleman Hills, which came in out of control with a capacity of 65,000,000 feet of gas daily and 3,000 bbls. of oil of 60.5 per cent gravity. Tests indicated a well pressure of more than 3,000 pounds at a depth of 7,000 feet.

The proving of the Kettleman Hills Field caused Pacific Gas & Electric immediately to change its plans for constructing a line from Ventura, some 160 miles farther south and across a mountain range. Less than two months after the bringing in of the original Kettleman Hills well, Pacific Gas had authorized construction work on a pipe line from that field. Actual construction was begun in February, 1929. The new plan included piping gas from the Buttonwillow Field, some 270 miles south of San Francisco, in order to insure an adequate supply of gas.

The first pipe line, known as the Bay line, was completed in August, 1929, and the first natural gas was delivered on August 15, 1929, at the company's Potrero gas plant, where it was used under a boiler one hour after its arrival in San Francisco.

Soon afterward, it became evident from the drilling of additional wells in Kettleman Hills that tremendous quantities of gas were available in the field. Geologists agreed that the field could produce 400,000,000 feet of gas daily over a period

(Continued on Page 188)

DETROIT CITY COUNCIL DISCUSSES CONTRACTS

DETROIT, Mich., Nov. 10.—John H. Morgan, city statistician, has recommended to the city council that permit to pipe natural gas for industrial use into Detroit from Kentucky, as requested by the Northern Industrial Gas Co., be held up until Northern Industrial or any other company contracts with Detroit City Gas Co. for distribution of natural gas here. Detroit City Gas Co. is a subsidiary of American Light & Traction Co.

By combining the facilities of the natural gas supplier with the local gas company "the benefits of lower price and better quality natural gas would accrue to the domestic consumer as well as to industrialists," Mr. Morgan said. "The most practical plan would be to distribute all the output of the natural gas company in Detroit to two systems of pipe lines; the Detroit City Gas Co. to organize a separate industrial division to furnish natural gas to industrial users only and to use excess natural gas received to make a mixed gas composed of coke oven and natural gas for distribution to residential and commercial users, reserving its present coal and water gas facilities as a standby reserve."

LOCKWOOD SUCCEEDS WILLIAMS

OIL CITY, Pa., Nov. 8.—L. E. Lockwood of this city was made president of the National Transit Co. to succeed F. D. Williams, who for 10 years headed the company but who recently resigned. Mr. Lockwood started pipe lining as a telegraph operator for the National Transit Co. He was steadily promoted, rising to the position of president of the Crescent Pipe Line Co. When that line was discontinued he was made a director of the National Transit Co.

PEOPLES GAS PLANS

NEW YORK, Nov. 10.—Applications made to the New York Stock Exchange for the listing of new securities included that of the Peoples Gas Light & Coke Co. for the listing of 62,450 additional shares of common stock. This stock was recently offered to shareholders in the ratio of one new share for each 10 held at the part value of $100. It is understood the company plans to use a part of the proceeds of the sale of stock in its arrangements for the piping of natural gas to Chicago. It is believed the company's system in Chicago will have to be rearranged to allow for the distribution of the gas.

PACIFIC GAS LINES

LOS ANGELES, Calif., Nov. 8.—The Pacific Gas & Electric Co. seeks permission to construct a natural gas transmission line from Kettleman Hills to Fresno, costing approximately $1,000,000, which will connect with the Fresno-Merced line. The company plans the construction of a $670,000 extension to its Fresno-Merced gas line to connect with the lines of the Southern California Gas Corp. at Fresno.

STEEL INDUSTRY LOOKS FOR EARLY PIPE ACTIVITY

By B. E. V. Luty

PITTSBURGH, Nov. 10.—No important line pipe orders have been reported recently. This year active buying began in March and as that was only three months after the big financial disturbance there is obviously a chance that activity will begin earlier next year. In certain descriptions of line pipe there remain some orders on books which would take quite a while to complete. Small lot orders are being placed right along, chiefly for laying in the south, and this is expected to keep up through the winter months. Approximately May to September, inclusive, production of line pipe was at capacity production slipping off since October 1 whereby it is now perhaps not much more than one-half its former rate. The decrease has been chiefly in fire weld. The three electric weld departments, at Milwaukee, Youngstown and McKeesport, near Pittsburgh, are all in operation.

The rate of steel production has slipped a little in the past week, the present rate being a trifle under 50 per cent of capacity, measured in the crude material, steel ingots.

Prices are easier in some directions. Light plate, blue annealed, is now quotable at 1.90 cents to 2 cents on 10 gauge, with strip mills sometimes making lower prices, while 13 gauge is commonly called 2.10 cents to 2.15 cents, being stronger than the heavier gauges. Nails are off 5 cents a keg, to $1.95, base. Bars, shapes and plates show no particular change. Single carloads of bars can be bought at 1.60 cents if the specifications are not too much mixed.

"FOUL AIR" FROM WELL NOW VALUABLE PRODUCT

The Hart County (Ky.) Herald contrasts 1867 and 1930 in the Horse Cave Field as follows:

"Shortly after the close of the war between the states in the days of reconstruction Horse Cave composed of a small citizenship of enterprising men, headed by Capt. Gorman Dock Young and later 'Uncle' Tommy Walton, established a tobacco manufactory on Main Street, one block from the Dixie Highway. The factory was not going good for lack of water, so they decided to employ a Mr. Diamond, an expert well man, who owned a fine rig, which consisted of a long supple pole, a 300-foot homemade rope and a homemade drill, that was operated by burying one end of the pole in the ground and the rope at the small end of the leaning pole with a see-saw motion. They succeeded in going a little over 200 feet only to meet disaster, having drilled in a well blowing foul air which they hurriedly plugged with a cedar post, fearing the inhabitants would be made ill.

"Today this same foul air is sought by many operators. To see the difference in now and then, go visit the Hart and Metcalfe County oil and gas fields. You will see miles of pipe lines under construction and already constructed, conveying the same, so called, foul air to distant cities to be consumed. You will also see tanks lined up; each well with its battery of tanks taking care of crude petroleum that has supplanted the homemade tallow candle of the good, old bygone days.

"Hart and Metcalfe citizens are proud of their oil and gas fields and also proud and appreciative of all those operators who have the grit to make it possible and keep it going, with at least 50 rigs in the field and more coming every day. Sixty cars of petroleum shipped from Horse Cave produced by four wells with new wells coming in right along is very encouraging."

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ENAMEL

For small lines the usual sling method of application is the simplest and fastest.

For big lines, our patented Rolling Rig method makes a perfect application with little labor, great speed and a considerable saving in material.

RAPID and economical application under field conditions is a self-evident requirement of any pipe coating.

Bitumastic Enamel works fast. Cleaning is reduced to the minimum by a coat of ***Bitumastic Shop Coat Solution*** applied at the steel mill. This is recommended in all cases. Because the enamel hardens instantly when applied, the coated pipe can be handled at once and back filling can begin as soon as it can be lowered into the ditch. The time involved is much less than with cold coatings, which require time to dry after application.

For fast economical work in the field, no protective covering equals ***Bitumastic Enamel*** because it is applied with common labor and is ready for handling at once.

WAILES DOVE-HERMISTON CORPORATION

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Central West Development is Steady

Much Interest Manifested in Search for Gas. Twenty Completions in Central Ohio. Drilling in Missouri

By George A. Whitney
Staff Correspondent, Central West Fields

FINDLAY, Ohio, Nov. 10.—Up to the present time development work is as steady as it any time during the season. Work will no doubt continue in the Central Ohio Field; also in Hardin, Seneca and Wyandot Counties, in the old Lima Field and in southern and southwestern Indiana, where gas is found at comparatively shallow depths, when compared with some of the more western fields. Kentucky and Tennessee will both get much test work for gas, more so than for oil. Much interest is manifested in the outlook for gas in many parts of Michigan, but the best looking gas producing territory in the Wolverine State appears to be in Isabella County, westward from Mount Pleasant, where wells showing from 5,000,000 up to 11,000,000 feet have been discovered.

Old Lima Field

Only three completions were reported in the Old Lima Field of northwestern Ohio, one of which is an oil well good for 10 bbls. drilled by H. F. Kelley and others on the Irville Hanes farm, Section 19, Perry Township, Allen County. In Pleasants Township, Hardin County, in the southeastern part of the old Trenton Rock area, the Wiser Oil Co. drilled a light gas well on the Clarence E. Ruhlen farm, Section 18, at a total depth of 1,359 feet. The Penn Oil & Gas Co.'s test on the L. A. C. Whitmore farm, Section 5, same township, was dry at 1,386 feet. In this same township, Barnaby and others are drilling Nos. 3 and 4 Jacob Kurt farm, Section 7. Hardin County Quarries Co. is starting a test on its own property, Section 6, and Bert Sheldon and others are starting No. 1 George Schwemmer farm, same section. In Blanchard Township, Neely & Underwood are starting No. 2 on the Phoebe L. Gardner farm, Section 31, while in Cessna Township, Egan & White are starting No. 1 Gardner farm, Section 12.

Eilerman Oil Co. is drilling No. 2 George W. Treibers farm, Section 26, Cynthian Township, Shelby County.

In Union Township, Mercer County, the Lima Pipe & Supply Co. has abandoned Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 and 20 on the George F. Griffin farm, Section 1.

In York Township, Van Wert County, Margaret E. Grace abandoned Nos. 1, 2, 3 and 4 G. W. Crone farm, Section 21, and Nos. 1 and 2 W. H. Lloyd farm, Section 21.

The test of the Honey Creek Oil & Gas Co., on the G. H. Berton farm, Section 33, Scipo Township, Seneca County, that was supposed to be of little value, is reported to have almost filled with oil to the top and may yet make a commercial well. It went 374 feet in the Trenton lime to a total depth of 2,375 feet.

CENTRAL OHIO

Twenty completions were reported from the Central Ohio Field, of which nine were producers with an initial production of 138 bbls., six dry holes and five gas wells, while in new work starting there were 16 locations made and 23 wells started spudding, a total of 39. This field which is both an oil and gas producing region maintains its usual activity, due principally to the finding of natural gas.

In Ashland County, Jackson Township, the Kemrow Co.'s No. 1 Silas Weidman farm, Section 4, failed to find any sand and goes as a duster. Wile and others' No. 3 Henry Mosher farm, Section 22, Lake Township, pumped 5 bbls. initial from the Berea sand from 586-612 feet. In Perry Township, Clifford & Kolb found a dry hole in No. 6 Ira Myers farm, Section 20, at 704 feet, and Eddy and others are drilling No. 4 Edward Gardner farm, Section 29.

In Medina County, Lafayette Township, Ohio Fuel Gas Co.'s No. 1-5,303 Emma T. Hutton, Section 22, is a gas well. In Chatham Township, the Oko Oil & Gas Co.'s No. 44 Henry Essig, Section 13, pumped an initial of 25 bbls. from 380 feet. Curtis and others' No. 2 Thomas Brown farm, Section 22, pumped 3 bbls. at 407 feet, and they are drilling No. 4 Howard Broadsword farm, Section 21. Peavy and others found a dry hole in No. 14 D. B. Stratton from 458-75 feet. Edson Co.'s No. 6 Marcus A. Frank farm, Section 20, pumped 2 bbls. from 417-29 feet and the company is drilling No. 7, same farm.

In Lorain County, Carlisle Township, Steel & Tube Co.'s No. 1 F. E. Schwartz farm, Lot 14, is a fair gas well in the Clinton lime from 2,280-84 feet. Lorain Oil & Gas Co. hit a duster on the Jacob Sorger, Lot 41, Ridgeway Township, no sand being found. McMillan and others made a location on the L. L. Blantern farm, Lot 12, Grafton Township.

Wayne County

In Wayne County, Chester Township, the Ohio Fuel Co.'s No. 1-5,292 is a light gas well in Section 17 on the Howard B. Ogden farm.

In Holmes County, Washington Township, the Ohio Fuel Gas Co.'s No. 1-5,305, Leroy Handenschild farm, Sections 8 and 9, is reported dry. East Ohio Gas Co. made a location for No. 1 W. B. Pyers, Lot 31, Hardy Township.

In Ashtabula County, Conneaut Township, Schaeffer Brothers report a nice gas producer on the E. A. Titus farm, Lot 60, from 2,744 to 2,754 feet.

In Knox County, Clay Township, I. C. Robinson made a location on the T. O. McKee farm, Section 11, and the Preston Oil Co. is drilling No. 2-1,458 W. S. Beatty farm, Section 2, Jackson Township.

In Coshocton County, Pike Township, McClay Brothers made a location for No. 1 Austin L. Rine farm, Section 5.

In Summitt County, Franklin Township, East Ohio Gas Co. made a location for No. 2 V. M. Grubb, Section 23. In Greene Township, same company is drilling No. 1 Henry Hausman, Section 17, and No. 1 L. S. Stark, Section 31, and also made a location for No. 1 W. J. Caston, Section 25, same township.

In Licking County, Emerald Petroleum Co.'s No. 1 Allen Johnson, Section 13, Fallsburg Township, is reported with an initial of 90 bbls. from 2,946 to 3,002 feet. Norpell and others are drilling No. 3 W. D. Booth, Section 14, same township. In Mary Ann Township, Armbruster & Stickler made a location for No. 5 William Strickler, Section 23. Preston Oil Co.'s No. 11,456 E. V. Levingston farm, Section 3, reported good for 2 bbls. from 568-581 feet.

In Muskingum County, Blue Rock Township, S. S. Holse made a location on the John W. Mohler farm, Sections 16-21. In Wayne Township, the Atha Co. is drilling No. 1 F. P. Arnold, Section 1, and No. 1 on the Julia Dietenbuck farm, Sections 9-12, same township. This company has a well under way on the George Heinle farm, Section 8, same township, which reached a reported depth of 3,526 feet. In Perry Township the Wittmer Properties Trustee's No. 1 on the Frank Border farm, Section 15, is a fair gas well at 3,920 feet. In Monroe Township, Fetty & Loucbary's No. 1 John Hawthron farm is reported as a dry hole.

In Athens County, Lee Township, Townsend and others' No. 1 Marchant Estate, Section 5, is reported good for 3 bbls. at 1,120 feet. Bode and others' No. 14 W. W. Whaley farm, Section 24, Alexander Township, produced 2 bbls. from the Berea sand at 1,198 feet. Orange Gas Co. is drilling No. 1 I. S. Swartz farm, Section 25, Carthage Township. Frank O'Mara and others are starting a test on the Nelsonville Lumber Co.'s land, Section 24, York Township.

Tuscarawas County

In Tuscarawas County John Glass is drilling on the John V. Coventry heirs farm in Lots 17, 22 and 29, Cozen Township. Blackstone and others are shut down on the Adam H. Boltz farm, in the second quarter of Warrick Township, at a depth of 3,488 feet, but will drill deeper.

In Stark County, Jackson Township, East Ohio Gas Co. is drilling No. 1 T. K. Harris farm, Section 34, and has made a location for No. 1 H. S. Belden, Jr., farm, Section 24. Same company is drilling on the J. M. Blake, Section 2, Perry Township.

In Fairfield County, Walnut Township, the Gas Producing Co. of Ohio drilled in a test on the J. and S. Holliday farm, Section 14, getting a 6-bbl. pumper at a depth of 1,967 feet. City Natural Gas Work is starting No. 3 well on the Charles Mertz, Section 23, Pleasants Township.

In Belmont County, Somerset Township, Easmuth-Callahan Gas Co. is drilling on the Butler-Davis farm, Section 23. Frank Stranges and others are drilling No. 3 Shriver-Dalles farm, Section 27, Union Township.

INDIANA

The only oil producer found in the Indiana Field was the United Oil Corp.'s No. 4 in the northeast corner of the H. Atkinson farm, NE Section 22, Logan Township, Pike County, with a production of but 1 bbl. at a depth of 1,040

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LEGRANDE POOL, HART COUNTY, KY., MOST ACTIVE EAST OF MISSISSIPPI

By George A. Whitney

CAVE CITY, Ky., Nov. 10.—The new Hart County oil field around Legrande is undoubtedly the most active locality east of the Mississippi. No less than 35 drilling rigs are running within a radius of 5 miles of the discovery well on the McKinnie farm, and more are said to be on the way, with three complete outfits on the siding at Horse Cave awaiting transportation to their locations. Horse Cave is experiencing all the thrills of a typical western oil boom, hotels are overflowing, restaurants and boarding houses are doing a thriving business; added to which a gang of some 50 pipe line men of the Missouri-Kansas Pipe Line Co. is making headquarters in the small town while laying a new 4-inch line from Legrande to Mumfordsville.

Horse Cave is the nearest railroad point to the field; it is also on the short link connecting the two north and south highways through western Kentucky, the Jackson Highway being joined at Bearwallow with a 4-mile improved road to the Dixie Highway, the junction being at Horse Cave, which acquired nation-wide fame a few years ago when Floyd Collins lost his life in one of the many small caverns found in the Mississippi lime throughout this section of the State.

A very interesting feature connected with this field is that it seems to parallel a "ridge" or fold extending some 15 or 20 miles in a northeasterly-southwestwardly trend, and that at various places along the "ridge" commercial gas wells have been drilled during the past 10 or 15 years without attracting the attention of the Kentucky operators. Small gas wells have been producing east and west of Greensburg, in the adjoining county, for several years, many of which have been utilized in making carbon black and in heating and lighting villages and towns throughout that section. During recent years one or two syndicates in Glasgow drilled several wells and piped Glasgow where they built up quite a profitable gas business, and last winter sold their production and property to a Chicago party named Stephens. All this development was duly reported in the press and yet no one outside the surrounding counties gave it any heed, even when the Missouri-Kansas Pipe Line Co. saw its possibilities and started laying an 8-inch line into the field. In fact the story goes that several of the most active Barren County operators began lapsing their leases around Seymour and Legrande, stating they had lost faith in that part of the field because of a string of dry holes which seemed to cut it off from the gas producing area.

Origin of the Play

It was about this time that an old-time gas operator and contractor, B. F. Wilson, of West Virginia, who had been living in Bowling Green since the big boom there, saw the possibilities of a region with such a history and took up some 12,000 acres in the general trend and along the line of the Missouri-Kansas pipe line, with a view of being content to drill 600-foot wells with an average yield of 300,000 to 500,000 feet of gas daily. He later made a deal with Dr. L. C. Young of Lexington whereby the latter was to develop about 1,200 acres and the initial well was drilled on the Tom L. Caudill lease, about half a mile southeast of Legrande and found gas in the sands above and below the Chattanooga shale, estimated at something like 600,000 feet. This new well caused the Barren County operators to renew their leases where possible and Norris and others spudded in a well on the McKinnie farm; this latter well came in flowing something like 200 bbls. of oil and "blew the lid off," and the excitement has not abated yet, as is demonstrated by the 35 drilling rigs now in the field. Thus did a field that was expected to produce only gas turn itself into an oil field overnight and incidentally upset many a well laid plan, for in 24 hours a locality where the operators intended to proceed in a dignified and orderly routine of development, became crowded with speculators, lease hounds, scouts and all the excitement attendant upon a big strike. Operators from Bowling Green, Owensboro, Lexington, Illinois, Indiana, Oklahoma, West Virginia and many other states have inspected the field and endeavored to close deals for acreage, in many instances paying substantial prices. The Stoll Oil Refining Co. of Louisville promptly laid a 2-inch line from Horse Cave to the field and announce that if necessary will lay a larger line immediately from Legrande to Hodgenville where it is assured a lower rate to Louisville than is quoted by the L.&N.R.R.

No hint of curtailment of the output

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PERFORMERS

OF THOROUGH ENGINEERING

cycle gas engine driven compressor units after they had been in service for about four years in Plant No. 13 of the Sinclair Oil and Gas Company, located in the Seminole field. (Some of these engines have recently been moved to other plants.)

CORPORATION, MT. VERNON, OHIO., GROVE CITY, PA.

Larger Number of Wells in the East

West Virginia Has an 8,000,000-Foot Gas Well. Twenty-two Completions in Southeast Ohio Area

By Staff Correspondent

PITTSBURGH, Pa., Nov. 10.—In spite of the declines in prices there were 47 wells reported in the eastern fields, a greater number than for several months. In addition, the largest gas well that has been completed for many months was reported from West Virginia. It was the Carnegie Natural Gas Co.'s test on the J. A. Lowther farm on the waters of Lick Run of Bear Fork, Troy district, Gilmer County, and was struck at a depth of 1,907 feet and in the Big Injun sand. It is estimated good for 8,000,000 feet a day.

SOUTHEAST OHIO

Among the 22 wells reported completed in Southeast Ohio, the largest was in the pool operation in Fallsbury Township, Licking County, where the test of Bebout and others on the Amos Vanwinkle farm, in Section 13, was completed in the Clinton sand at 2,975 feet and produced 100 bbls. the first day after shot. In the pool in Guernsey County, Wheeling Township, the Ohio Producing & Refining Co. completed a second test on the Joseph and Retta Gadd farm, SE Section 10, in the Niagara lime at 3,513 feet and it made 65 bbls. natural the first 24 hours. Another fair well was the Capital Drilling Co., Inc.'s No. 4 on the Little and Swigert farm, in the SE Section 32, Washington Township, Tuscarawas County. It was drilled in the Niagara lime at 3,688 feet and also produced 65 bbls. the first day natural. In Muskingum County, the Pure Oil Co. completed No. 3 on the A. N. Holman heirs farm, Section 6, Jackson Township, in the Clinton sand at 3,008 feet and, after shot, it produced 50 bbls. the first day.

In Section 22, Lake Township, Ashland County, the S. & W. Oil & Gas Co. completed No. 3 on the W. H. Mosher farm in the Berea sand at 622 feet which after shot produced 15 bbls. the first day. In Athens County, the Kachelmacher estate drilled a test on the Charles W. Wilson farm, Section 4, Trimble Township, in the Clinton sand at 3,993 feet and it is dry. In Section 25, Carthage Township, the Ohio Fuel Gas Co. completed a second test on the B. W. Barnhill farm in the grit at 1,230 feet and this likewise proved dry.

In Guernsey County, George Jewell and others drilled a test on the Albert Beal farm, NE Section 12, Wheeling Township, in the Niagara lime at 3,634 feet and it made 12 bbls. the first day natural. Licking County had three other completions. In Section 1, Perry Township, Kundtz, Hulse, Inc. completed No. 13 on the Joseph Chaney farm in the Berea grit at 695 feet which produced 6 bbls. the first 24 hours after shot. In Lot 3, Mary Ann Township, F. B. Settles drilled a second well on the David Wright farm, and this will make a 1½-bbl. pumper from the Berea sand at 598 feet. On the same lot, and the Bessie Livingston farm, the Preston Oil Co. completed No. 2 in the Berea sand at 583 feet and this is rated a 1-bbl. pumper.

Medina County

In the shallow sand operation in Medina County, there were three completions, all by E. R. Edson & Son Co. They were No. 31 on the W. H. Ripley farm, Lot 1, Section 13, Chatham Township, completed in the Mitchell sand at 468 feet and good for 6 bbls. the first day after shot; No. 4 on the M. A. and Eva Franks farm, Lot 20, Section 16, Chatham Township, drilled to a depth of 456 feet and in the Mitchell sand, which produced 3 bbls. the first 24 hours after shot; and No. 28 on the Daniel Ross farm, Lot 7, Section 13, Chatham Township, which made 1 bbl. the first day after being shot in the Mitchell sand at 422 feet.

There were, in addition to the one fair well reported, two gas wells and two small oil wells, reported from Muskingum County. The Ohio Fuel Gas Co. completed a test on the Isaac Wolf farm in Washington Township in the Clinton sand at 3,910 feet, and it is estimated good for 500,000 feet a day. In the NE Section 5, Brush Creek Township, the Ohio Fuel Supply Co. completed a test on the Maggie Boyd farm in the Clinton sand at 3,968 feet good for 200,000 feet a day. Arthur McCune & Co. drilled a second test on the J. W. Rusk farm, NW Section 17, Harrison Township, in the Berea grit, 1,170 feet. It made 5 bbls. the first 24 hours after shot. James E. McLaughlin completed his No. 6 on the Richard Brice farm, Section 13, Monroe Township, in the Berea sand at 1,090 feet and it is showing for a 3-bbl. pumper.

In the SE Section 6, Jefferson Township, Noble County, Ogle and Ogle completed No. 17 on the Benj Corp. property in the Buell Run sand at 260 feet and there was no showing of oil or gas. In Perry County, G. Berlin and others drilled a test on the Mike Emmert farm, SE Section 22, Reading Township, and a depth of 940 feet in the Berea grit. It was making 250,000 feet of gas. The Ohio Producing & Refining Co. completed No. 3 on the Joseph and Retta Gadd farm, 450 feet east of the township line and in the NE Section 5, Monroe Township, Tuscarawas County. It was drilled in the Niagara lime at 3,706 feet and is dry.

In Vinton County, the Co-operative Oil Co. completed a second well on the Robert Nelson farm, near Bollins Mills, Section 4, Knox Township. It went to the grit and a depth of 1,038 feet and it will make a quarter-barrel pumper.

Drilling in Ohio

In Washington County, in the shallow sand drilling, the Jones Drilling Co. spudded in on the William Kinsey farm, Lot 40, Salem Township. In other sections of this county, there are few new tests starting. In Section 4, Ludlow Township, J. F. Graham and others are down to 1,300 feet on the Mary Edwards heirs farm. In Liberty Township, C. E. Smith and others spudded in and are drilling No. 4 on the William Grosheart farm, Section 10. In Palmer Township, the Swingle Oil Co. is drilling on the Clarence McGrew farm, Section 7. In Section 2, of the same township, the Pure Oil Co. is drilling on the J. F. Reed farm. In Fearing Township, John T. Cleary and others are drilling a second test on the Jacob Morningstar farm, Section 34.

In Medina County, Harrisville Township, which is a gas area, the Ohio Fuel Gas Co. has started a test on the William L. Barnhart farm, Section 20, and in Section 56, Meyers Brothers and others are down to 2,550 feet in No. 8 on the G. P. Mong farm. In Section 6 of this Township, Barnhart and others have spudded in for No. 3 on the Joseph Funk farm. In the shallow sand operations in Chatham Township, drilling is still very active, and though the price of crude is very low, is profitable.

In Carroll County there are five wells still drilling at various depths from 1,000 to 1,350 feet, but no reports of completions.

WEST VIRGINIA

There were 26 wells completed in West Virginia and of these 6 were small oil producers. In Hancock County, R. J. Braden completed his No. 45 on the C. E. Brenneman farm in Grant district good for 5 bbls. In Washington district, Kanawha County, the Cambridge Gas Co. completed No. 1 on the Rome Pickens farm at 3,682 feet and it is showing for an oil well and at present is waiting on a shot. In Marshall County, Liberty district, there were two wells completed, both of which have a light show of oil. They were the test of the Loudensville Oil & Gas Co. drilled deeper on the O. S. Clark farm to a depth of 3,117 feet and the test of the Twin Oak Oil & Gas Co. on the W. E. Parriott farm completed at a depth of 3,100 feet.

In Ritchie County, J. W. Jones completed his No. 28 on the West Virginia tract in Grant district to the Salt sand and it is showing for about one-half barrel. Elias and Gordon completed No. 3 on the Clara McDougall farm on Plum Run, Williams district, Wood County, in the Salt sand and it will make a 1-bbl. pumper.

Gas Wells

The second largest well for the week in West Virginia was the test of W. S. Dailey and others on the J. A. Maze farm in Sheridan district, Calhoun County, which was drilled in the Keener sand at a depth of 1,717 feet and is showing for over 1,000,000 feet a day. In the same district the Chemical Oil Co. completed No. 2 on the Harriet Fling farm on Yellow Creek in the Injun sand at 2,068 feet, and it is a fair gas well. In Clay County, which of late has been inactive, there were several wells completed. The United Fuel Gas Co. completed No. 4,073 on the Brown, Swann and Goshorn tract in Henry district in the Big Injun at 2,141 feet and it is a small gas well. In the same district the Thompson Gas Co. completed a fair gasser in No. T. 26 on the O. E. Swarts farm in the Salt sand at 1,566 feet and a light gas well in No. T. 23 on the Grose and Cunningham tract in the Salt sand at 1,493 feet.

On Lick Run of Bear Fork, Troy district, Gilmer County, in the same district that the Carnegie Natural Gas Co. completed its large gasser, the Philadelphia Oil Co. completed No. 1 on the Jess I. Spurgeon farm in the Big Injun at 1,855 feet, showing for a fair gas well. Formerly, this was reported as a 3-bbl. oil well but with two packers the oil was packed off to complete it as a gas well. In Fayette County the Montgomery Gas Co. drilled No. 7 on the New River Colliery Co. tract in Kanawha district to a depth of 2,715 feet and it is showing for 500,000 feet a day.

Harrison County

The Reserve Gas Co. drilled its test on the J. H. Sommerfield farm, Union district, Harrison County, and on the waters of Isaac Creek of West Fork River, deeper from the Fifth sand to the Speechley sand and it will make a gasser. In Mingo County the Red Jacket Oil & Gas Co. completed No. 14 on the Red Jacket Consolidated Coal & Coke Co. property in Harvey district in the Maxon sand at 1,230 feet and it is a fair gasser. In Lincoln district, Marion County, the M.W.P.P.S. Co. struck a showing of gas at 2,410 feet in its test well on the L. Hawkenberry farm. This well is still drilling and has now reached 2,550 feet.

In Monongalia County a first completion for several weeks, the J. H. McDermott and Moore-Tex Oil Co. completed a test on the N. A. Moore farm on Jakes Run in Clay district. It was drilled in the Bayard sand at 2,923 feet and will make a fair gas well. In the same district the second test of the Pittsburgh & West Virginia Gas Co. on the Jane Lough farm is dry at a depth of 2,300 feet. In Roane County the United Fuel Gas Co. completed two wells. In Geary district, its No. 4,252 was completed in the Injun sand at 2,197 feet on the J. M. Moore farm and is good for 200,000 feet a day natural. In Smithfield district its No. 4,281 on the J. A. Keffer farm is showing for slightly larger from the same sand at 1,946 feet.

In Upshur County the C & A Gas Co. completed a test on the W. P. Snyder farm in Washington district in the Benson sand at 3,989 feet and it is a light gas well. In Wayne County the Wayne United Fuel & Gas Co. completed No. 18 on the A. W. Wilson farm in Lincoln district at 2,600 feet and being dry in all sands was abandoned. In Wetzel County D. W. Null and others drilled a test on the W. Barrack farm in Church district to 2,948 feet and have a gas well.

There were three completions in Wood County. In Williams district L. W. Bickle drilled a test on the Ben Mayo farm and it was dry. In Union district Charles S. Smith had a similar result in his No. 4 on the Dora McAteer farm. The third was the small Salt sand oil well.

Drilling in West Virginia

In Monongalia County the Union Gasoline & Oil Corp. is down to 2,000 feet on the Wise heirs farm in Battelle district. In Clay district the Pedlar Run Oil Co. has had to shut down on account of no water on the Lewis R. Hess farm after reaching 2,485 feet. In the same district the J. H. McDermott and Moore-Tex Oil Co. test on the Lou and Amy Tennant farm has reached 2,050 feet and the second test of the Pittsburgh & West Virginia Gas Co. on the Jane Lough farm is being drilled deeper after being dry in all sands to 2,300 feet.

In Tyler County the Union Gasoline & Oil Corp is drilling No. 2 on the William and Maria J. Way farm, McElroy district, deeper from the Maxon sand to the Gordon sand and it is drilling at 1,850 feet. In Meade district the Ohio Oil & Gas Co.'s test on the S. J. Martin farm has reached 900 feet. In Church district, Wetzel County, the Wetzel Gas Co. is down to 2,500 feet on the Francis Barrack farm, and the Burton Development Co. has started drilling on the Etta Kerns farm. In Doddridge County, J. H. Pentz has started his No. 4 on the Zed and Mary Underwood farm in McClelland district.

In Marshall County the Union Gasoline & Oil Corp. has three rigs standing. In Liberty district there is one on the W. H. Loper farm and one on the J. M. Rine farm. In Cameron district there is a rig up on the W. B. Hicks farm. In Central district, Doddridge County, Pigott and Shinn have reached 1,600 feet on the J. R. Hiley farm. In Gilmer County there are five rigs standing. In Troy district the Middleton Natural Gas Co. has a rig standing on the Perry Woofter farm. In DeKalb district, Roberts and Moorehead have a rig standing for No. 3 on the George Miller farm, and the Gainer Farm Oil & Gas Co. has rigged up on the Cedelia Collins farm. In the same district, Park Bowser has completed his rig on the J. R. Polson farm, and A. E. Ellis and others have a rig standing on the George H. Bush farm.

Wirt County

In Clay district, Wirt County, F. L. Andrews has spudded in on the J. W. Hickman farm in Burning Springs district, and Pollack and Myers have started their test on their own property in Clay district. Lee Batten and others are down to 1,875 feet on the S. L. Showalter farm, Reedy district, and the Heck Oil Co. is drilling at 750 feet on the H. L. Vandall farm, same district. Richmond and Davis are down to 1,365 feet in their test on the John Newman farm, Reedy district. In Jackson County, Starr and others have shut down at 2,300 feet on account of no water on the Harvey Starr farm, Grant district. In Ravenswood district, the South Penn Oil Co.'s No. 14 on the C. S. McCarty farm, which has been very productive, is down to 1,100 feet. In McKim district, Pleasants County, C.

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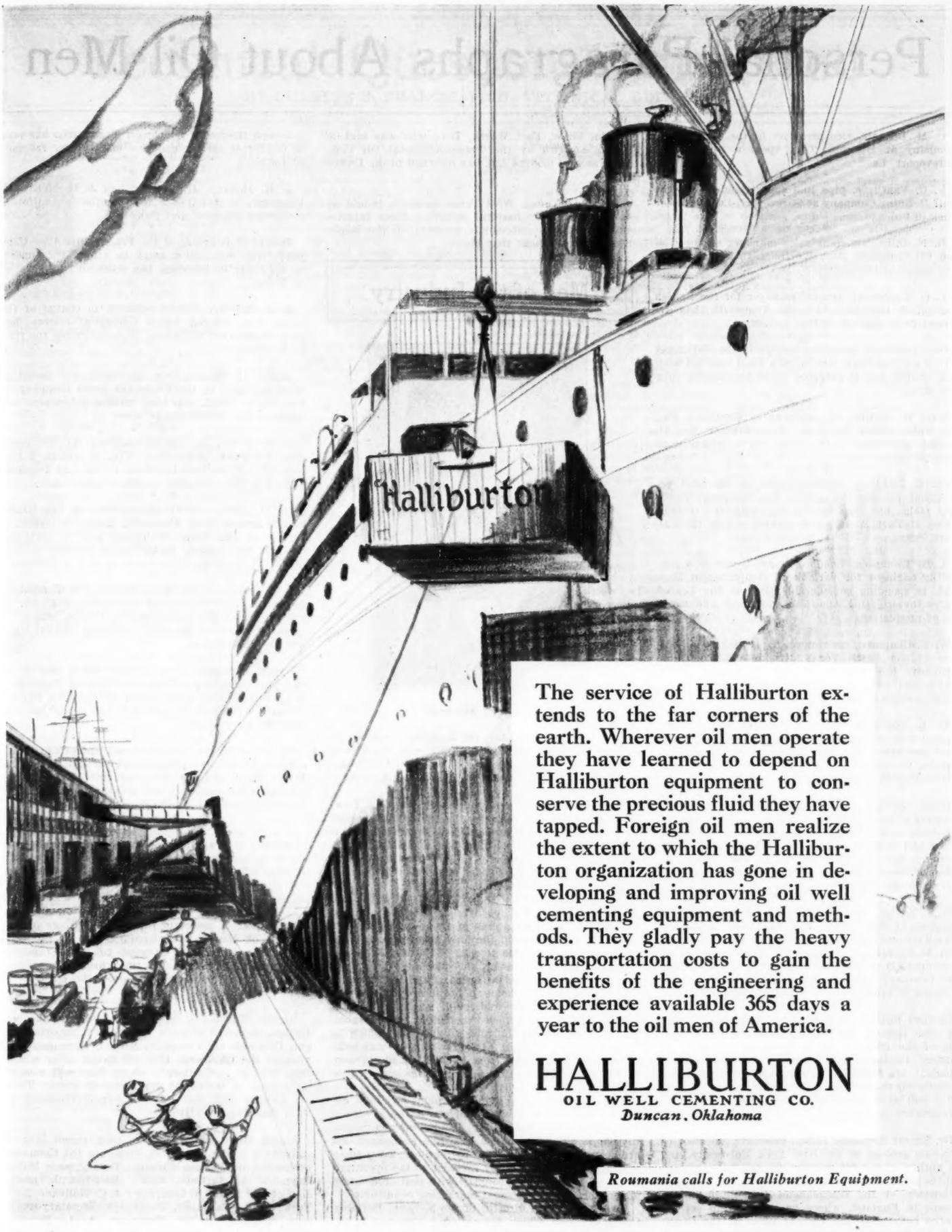

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Name_____ Address_____

Personal Paragraphs About Oil Men

C. M. Bennett, vice president of the Vacuum Oil Company at Houston, Tex., spent a week-end in Shreveport, La.

* * *

F. C. VanCleve, pipe line superintendent for the Gulf Refining Company at Shreveport, La., spent the week in Chicago.

* * *

R. N. Cline, assistant sales manager of the Cosden Oil Company, Fort Worth, Tex., is spending a few weeks at Cloudcroft, N. M.

* * *

F. G. Rappoport, general manager for the British Controlled Oilfields, Ltd., in Venezuela, has returned from London to that country.

* * *

Otto Bradford, proration umpire in the Oklahoma City Field, has been laid up in a local hospital with foot trouble but is expected to be functioning in a few days.

* * *

Burt H. Collins, oil producer of Bradford, Pa., is a Tulsa visitor, the guest of his brother, Ray M. Collins, president of the Echo Oil Company, and state proration umpire.

* * *

W. E. Haggard, superintendent of the land department for the Continental Oil Company, Ponca City, Okla., has been visiting the company's district office at Fort Worth, and making a trip through West Texas.

* * *

A. B. Thompson, London, England, who is a consulting engineer for various oil companies in England, is spending considerable time in the United States investigating American equipment and methods of production.

* * *

W. E. Chapman, assistant to L. E. Barrows, manager of the North Texas division of The Texas Company, has suffered a general breakdown in health and has decided to spend a year in West Texas recuperating.

* * *

R. B. Rutledge, district geologist at Wichita, Kans., with Skelly Oil Company, has been made chief geologist with headquarters in Tulsa. Earl A. Trager, formerly chief geologist, has resigned and will engage in consulting work.

* * *

Glenn Skinner, secretary-treasurer and general manager of the Black-Sivalls-Bryson Tank Company, has been making the rounds of district offices in Texas and Shreveport, La. James Longabaugh, who formerly had headquarters in Oklahoma for the company, has been transferred to Tyler, Tex., and will cover the East Texas district.

* * *

E. J. Sadler, vice president of the Standard Oil Company of New Jersey, with headquarters in New York City, will be the principal speaker at a banquet to be held in Springfield, Mo., November 14 in honor of H. S. Austin, president of the Ajax Pipe Line Company. All officials of the Tulsa office will be taken to Springfield in a trimotored airplane.

* * *

Edward Boaden, engineer with Societatea Unirea Anonima Romana de Petrol, the Rumanian subsidiary of the Phoenix Oil & Transport Company of London, England, has completed his tour of the principal oil fields of this country and sails for England on the Britannic for Liverpool on November 8 and after spending a short time in England will proceed to Rumania.

* * *

Dr. Ernest Raymond Lilley, associate professor of economic geology at the New York University, and the author of several volumes dealing with geology and the oil industry, who was awarded the Research Fellowship of the Guggenheim Foundation, is at present in England, where he will remain several months before visiting various parts of the Continent. He is studying mining conditions in general. He was the guest of honor at the monthly luncheon of the Oil Industries Club in London, October 31, when he delivered an address.

John Shaw, Fort Worth, Tex., who was sent to South America by the Transcontinental Oil Company several months ago, has returned to the United States.

* * *

Dr. J. D. Young, West Texas operator, is laid up in a Sweetwater hospital suffering from injuries sustained in an automobile accident on the Bankhead Highway near that place.

Men of the Industry

John C. Howard

The story of the Utah Oil Refining Company, a major industrial concern of Utah and the Rocky Mountain area, is a record of the activities of John C. Howard, its president and general manager since its organization over 20 years ago.

Born in the mountain country of Utah, Mr. Howard's early training provided the background needed to found and build a permanent oil organization notwithstanding exceptionally adverse conditions. He went to work in a sawmill of southeastern Utah at the age of 10 and later aided his father in opening the first coal mine in Utah.

Mr. Howard went to Salt Lake City at the age of 12 and obtained a job driving a delivery wagon for one of the large stores of the city. During his spare time he acquired the only scholastic training that he was ever able to get. While still a young man he was selected by the Mormon Church to carry on mission work in Germany and Switzerland.

Returning to his home he organized a concern which manufactured and sold special oils and greases. This was followed in 1909 by the organization of the Utah Oil Refining Company, of which he became the active head. Its first refinery was built of equipment obtained from an abandoned refinery in Pennsylvania. In 1910 the plant was operated on 7 bbls. of crude oil daily.

From this small beginning the plant has been expanded until it is now a complete refinery with a capacity of 6,000 bbls. daily. The refinery is unique in that it never has had a pipe line connection, all crude supplies being received by tank car, a handicap which is only one of many incident to the operation of an oil concern in a country with scattered crude oil production and unusual marketing conditions.

Mr. Howard is a director of the Midwest Refining Company, with which his refining company is affiliated. He is also a director in the Utah Power & Light Company and several other industrial and banking concerns which operate in Utah and adjoining states.

Joseph Bruner of Southwest Texas, who has been in California for the past few months, has returned to Luling.

* * *

J. H. McEvoy, Jr., president of J. H. McEvoy & Company, is spending a few months in California combining business and pleasure.

* * *

Robert C. Bearden, of the Prairie Pipe Line Company, who was called away to attend the funeral of his sister in Missouri, has returned to his duties in Tulsa.

* * *

P. J. Hegwer, district engineer in charge of the Tulsa area, United States Geological Survey, has been transferred to Casper, Wyo., effective the first of November.

* * *

Edgar H. Wilson, vice president and assistant sales manager of the Globe Oil Tools Company of Los Nietos, Calif., has been making a business trip through the Mid-Continent area.

* * *

L. F. Keely, application engineer for the Louis Allis Company, Milwaukee, Wis., is making a trip through the Southwest visiting Dallas and Houston, Tex., and New Orleans and Shreveport, La.

* * *

M. M. Ryan, consulting engineer of the Black-Sivalls-Bryson Tank Company, Tulsa, is making a survey of the State of Texas, and is traveling through the various oil-producing sections of the State.

* * *

K. W. Gray, of the Anglo-Persian Oil Company's geological staff, has gained the degree of Doctor of Philosophy at the University of Vienna, where he recently completed his course of study. He has since left for Yugo-Slavia.

* * *

Byron Meredith of the Prairie Oil & Gas Company, at Tulsa, is spending some time in Shreveport in connection with development of Claiborne Parish. properties in which the company has a half interest with the Slick estate.

* * *

Dr. Cyrus N. Ray is again president of the Texas Archaeological and Paleontological Society. Dr. Julius Olsen is first vice president; E. B. Sayles, corresponding secretary and treasurer, and F. Earl Ingerson, recording secretary. All reside at Abilene.

* * *

J. J. Forbes of the United States Bureau of Mines at Pittsburgh, Pa., attended the second annual meeting of the safety division of the Louisiana-Arkansas division of the Mid-Continent Oil & Gas Association at Shreveport, La., at which he was one of the principal speakers.

* * *

R. L. Marek, associate petroleum engineer of the Bureau of Mines, with headquarters at the San Francisco office, has returned to San Francisco after making an extended trip through the Mid-Continent district in connection with the safety work of the bureau.

* * *

Nicolae Marineson, general manager, and Jacques Coulon, technical director and general superintendent, Columbia Oil Company, Moreni, Roumania, are visiting the Oklahoma City oil fields, after which they will go to California where they will remain on a tour of inspection for about 45 days. They are located with the Oil Well Supply Company in their Los Angeles office.

* * *

Among those who took part in a recent trip of inspection to Big Lake and Plymouth Oil Company properties in Reagan County, Texas, were Wiley Reynolds, of Jackson, Mich.; Levi Smith, president of Big Lake Oil Company; J. C. Hollister, New York; J. G. Farquhar, Pittsburgh, secretary-treasurer of Plymouth Oil Company; A. L. Romine, Cleveland; J. L. Clevenger, Jr., New York; J. C. Adams, Tulsa, attorney for Big Lake; and C. E. Beyer, general manager of the Big Lake Oil Company.

Technical Questions Answered

BY CHARLES K. FRANCIS, PH.D., TECHNICAL EDITOR

This department of The Oil and Gas Journal is devoted to the manufacturing branches of the oil industry.

Those connected with the refining of crude petroleum, the manufacture of natural gasoline and closely allied industries are invited to submit their problems to Dr. C. K. Francis, technical editor. The department was created for the purpose of aiding managers, superintendents, engineers, chemists and all those engaged in the various phases of plant operation; also those connected with the marketing and utilization of petroleum products.

Questions should be submitted in as much detail as possible so as to assure a satisfactory answer.

All inquiries should be signed and if other than the given initials are to be used please indicate the desired letters.

Questions involving patented processes, intricate formulas and calculations and estimates of costs, for obvious reasons, cannot be answered. The replies will appear on this page within a reasonable time.

PRODUCTS FROM NATURAL GAS

I have read of numerous substances, such as sugar, silk, perfumes, and many other things being made from natural gas and would like to know if such reports are founded on facts?—F. B. P.

The very interesting synthetical, actual and possible, combinations of carbon and hydrogen, as illustrated by the substances made from the closed ring compounds of the aromatic group has encouraged similar work within the open chain hydrocarbons. Many substances have been produced from the carbon compounds of the paraffin group so abundant in natural gas. The synthetic compounds that have been made on a large scale from the saturated hydrocarbons have been of relatively simple structure. Complex bodies such as the sugars have been prepared on a small scale in the laboratory from elementary material and probably could be made from natural gas.

Various commercial products are obtainable from natural gas through pyrolysis, or decomposition at high temperatures, recent experiments in this country and abroad have shown. The Bureau of Mines has demonstrated that when methane, the chief constituent of natural gas, is subjected to temperatures of 1,800 to 2,200 degrees Fahrenheit it breaks up or "cracks."

The hydrogen thus set free can be utilized commercially; either as a reducing agent in the process industries; for the hydrogenation of petroleum, coal or vegetable oils; for the synthetic production of ammonia and nitrogenous fertilizers and as a refrigerant.

Other gases formed in the pyrolysis process are acetylene, butadiene, ethylene, propylene and butylene. Acetylene is used in welding and cutting metal; to prepare acetaldehyde which is further utilized in silvering mirrors, or in the preparation of drugs such as chloral. Butadiene, under proper treatment, condenses to form an artificial rubber having the same general composition as natural rubber. Ethylene has recently come into use in ripening fruits and is also finding wide employment as an anesthetic.

The chief use for ethylene at present, however, is in the synthesis of ethylene glycol used as an anti-freeze for water-cooled motors, and the basis for a series of important lacquer solvents made by the same company.

Government chemists have employed natural gas in the production of formaldehyde, one of the most widely consumed chemicals. This compound finds extensive use in the manufacture of synthetic resins such as Bakelite, from which is fabricated a multitude of useful products.

A recent report from McGill University states that Professor Hibbert has produced a material similar to Rayon, artificial silk, from natural gas with carbon dioxide and water as the base materials.

AMMONIA AND HIGH SULPHUR CRUDES

Can you give any estimate of the value of ammonia for reducing corrosion when running high sulphur crudes? What quantity of ammonia should be used?—L. E. F.

There is some question concerning the value of ammonia for reducing sulphur corrosion but it is acknowledged to be effective for treating those oils which produce hydrochloric acid during the distilling operation. A good discussion of this subject is contained in the report presented by A. E. Harnsberger before the American Petroleum Institute, Chicago, December 4, 1929, which is quoted:

Installations are known where, with the use of caustic, it was necessary to renew the bottom collecting headers, gasoline coolers, and rundown lines in from three to six months; but when ammonia was substituted for the caustic, the life of these parts has been increased to over a year. The quantity of ammonia required varies from 3 pounds to 25 pounds per 1,000 bbls. of crude being processed; and at the prevailing price, is considered an economic procedure, in view of the decreased maintenance and increased time on stream of the equipment.

For sulphur corrosion, ammonia has not proved itself to be at all effective; and, after several trials, has been discontinued. Caustic is fairly effective, but makes cleaning of evaporators and fractioning towers a difficult task; and, furthermore, is attended with the danger of producing brittleness of steel parts. To date, the best results have been obtained by using hydrated lime. Under the most severe conditions at the furnace outlet, the corrosion has been reduced from 0.136 inch penetration per 1,000 hours to 0.225 inch penetration for the same period. This reduction is based on the injection of 0.25 pounds of lime per bbl. of crude oil charged, the crude being from the Winkler (West Texas) Field, containing 1.62 per cent sulphur. These corrosion rates were established by test samples. Results of using lime show that the life of tubes in the hottest part of the furnace has been increased from three months to well over a year, their ultimate life not being known at this time. Maintenance on this still has been greatly reduced as shown by the following table:

Maintenance Cost of 10,000-Bbl. Tube Still

Repairs for 1,000,000 barrels Throughput due to corrosion	Cost per barrel—Dollars: Actual maintenance	cost of lime	cost of ammonia	Total	Estimated Maintenance Cost per year (340 days)
$11,000	1.1			1.1	$37,400.00
1,900	0.19	0.171	0.0425	0.4035	6,460.00
	Saving maintenance only				30,940.00
	Less cost neutralizers				6,780.00
	Net saving per year				$24,160.00

This section of the report has dealt primarily with problems as related to pipe stills, since corrosion in these units has been most severe. In the case of shell stills, similar methods can be adopted. Lime or caustic can be injected into the charging lines of stills operating on high sulphur crudes; and, if properly agitated with steam, can be held in suspension and made to flow to the other stills. Condenser and heat exchanger corrosion can be combated with ammonia neutralizer.

ALCOHOLS FROM GAS

Has grain alcohol, or any form of alcohol, been taken from natural gas? If so, is it being done commercially?—C. L. O.

At this time no commercial installation for manufacturing ethyl, or grain alcohol, from natural gas or refinery gas is known. Ethyl alcohol has been made on a small scale from natural gas and refinery gas but the numerous efforts to enlarge the operation to commercial size have met with failure. The higher alcohols, such as propyl and butyl alcohol, are derived from cracked gas, such as refinery gas, because of the high content of the corresponding base unsaturated hydrocarbons.

The normal natural gas is essentially methane with very small quantities of other hydrocarbons of the paraffin group. Most of the commercial natural gas contains 90 per cent or more of methane and seldom does ethane exceed 10 per cent, with no unsaturated hydrocarbons present. Such material may be converted to alcohol only with considerable difficulty. When natural gas is heated to a high temperature, that is from 1,000 to 2,000° F., a series of unsaturated hydrocarbons is formed, several members of which are suitable for preparing the higher alcohols by comparatively simple methods.

Several patents covering the manufacture of alcohols from petroleum gases have been issued to Carelton Ellis and one of these was described in Petroleum Magazine, 10, 40; 1921. This process is based upon the (a) formation of olefins, such as ethylene, propylene, and closely related unsaturated hydrocarbons, in the process of cracking paraffin oils according to

$$C_{10}H_{22}=C_5H_{10}+C_5H_{12};$$

(b) the formation of an alkyl sulphuric acid by treatment with concentrated sulphuric acid,

$$C_5H_{10}+H_2SO_4=C_5H_{11}(HSO_4),$$

and (c) the hydrolysis of the acid to the corresponding alcohol,

$$C_5H_{11}(HSO_4)+H_2O=C_5H_{11}OH+H_2SO_4.$$

Manufacture of the alcohol under the Ellis patents is conducted by the Standard Oil Co. of New Jersey. The process is reported to follow this outline: Removal of the hydrogen sulphide and moisture by suitable absorbents in towers; conversion of the alkyl sulphate continuously in towers, or by the batch system in large tanks fitted with agitators; settling to remove oils; hydrolysis of the acid by mixing with several volumes of water; distillation of the alcohols; rectification; and reconcentration of the sulphuric acid.

One refinery produces 12,000,000 cubic feet of gas daily. The refinery gases contain considerable ethylene but its absorption requires high temperatures and high concentrations of acid while propylene is absorbed in the cold in simple absorption towers, consequently at the present time isopropyl alcohol, which for the most technical purposes will serve as well as ethyl alcohol, is the chief product of the plant.

TREATING CHEMICALS AND QUALITY

I will appreciate the favor if you will kindly advise where I can secure information concerning the chemicals added to or mixed with commercial gasoline to increase or pep up its efficiency. Is the color of a treated gasoline the result of a chemical used or is it a means of identity? What harmful or beneficial results may be expected from the use of a treated gasoline?—H. R. H.

The chemicals used in the refining of gasoline are for the purpose of removing objectionable impurities. The material obtained by the direct distillation of petroleum is usually contaminated with tars, gums, acids, and sulphur compounds which would tend to do damage to the ordinary motor if it were used. The finished gasoline is a purified product that may be compared to the crude oil in the same way that the fine steel of a watch spring is related to the iron ore. If the impurities were not removed from the metal it is certain that the spring would be of little value.

Color of itself has nothing to do with the power that may be developed from a gasoline and it does not necessarily indicate the presence or absence of objectionable impurities. Of course the best grades of gasoline are refined to such a degree that no tinge of color may be detected by the delicate instruments used for determining color of petroleum products; this grade of gasoline is said to have a color of +30 Saybolt in the United States. However, gasoline might be made to this grade of color and yet contain gum-forming bodies, acids, and sulphur.

The chemicals used in refining, when making gasoline, include sulphuric acid, hydrochloric acid, chlorin and chlorin compounds, sulphur, sulphur dioxide, silica gel, fuller's earth, litharge, sodium hydroxide, ammonia, lime, sodium carbonate, and other chemicals to a minor extent. There are a few compounds that are added to finished gasoline for special purposes, such as color inhibitors, gum inhibitors, and knock inhibitors.

Many gasolines are colored with a soluble dye for the purpose of preventing the gasoline from being used for any other purpose than a motor fuel and for marketing purposes.

CRANKCASE RESIDUE COMPOSITION

Could you furnish analysis showing the composition of the mud or carbon from crankcase oil? Is this formed from the lubricating oil or from the gasoline and does it change in character with the kind of oil and gasoline?—C. R. L.

The composition of the material deposited in a crankcase has little to do with the kind of lubricating oil or the gasoline but is considered to reflect the condition of the working parts of the motor and the road material over which the car travels. No general application of one analysis can be of value.

The analysis following represents the deposit taken from a car which had been reported to have been in operation in a district with few paved roads:

Found—	Per cent
Iron and aluminum	55.83
Oil	9.14
Carbon	5.39
Silica, as quartz	5.668
Silica, as muscovite	20.762

The total silica was in the form of large quartz grains and as black flakes of a mineral intimately associated with the quartz, but not decomposed by the acids hydrochloric, hydrofluoric, or sulphuric. This suggested the micas, concluded to be muscovite.

Water Supply and Treating Methods

Report Prepared Under Direction of Mid-Continent District Committee on Drilling Practice for A.P.I*

An adequate supply of suitable water is a matter of primary importance in the development of an oil field, and under modern conditions with rapid development by heavy steam driven equipment the quantities of water required may run into large volumes and may involve treating and distribution systems of considerable cost and magnitude. In the case of the Oklahoma City Field, for example, the average daily field water consumption at times during the current year will probably be at least double that of a neighboring city with its population of 180,000. It is considered, therefore, that any information and data that would assist in the development of a supply and treatment of the water obtained will be of interest.

It is seldom possible in the early stages of the development of a new field to predict with any certainty either its ultimate extent or the number of wells that will be drilling during the peak of activity, but some rough estimate can generally be made that will assist in arriving at a decision as to the source of the water supply and the type of the equipment to use. The following figures may be used in estimating requirements:

Heavy steam driven rotary drilling wells equipped with three or more boilers of 100 H.P. to 125 H.P., 250 to 350-pound working pressures	Feed water 2,000 bbls./24 hrs. Slush pits 400 bbls./24 hrs.
Light type steam driven rotaries equipped with not more than three 90 H.P. boilers, 175 to 200-pound working pressure	Feed water 1,000 bbls./24 hrs. Slush pits 300 bbls./24 hrs.
100 H.P. lease boiler	300 bbls./day.
45 H.P. gas pumping engine with circulating tanks	16 bbls./day.
Gasoline plants, including tower losses and feed water	1 bbl./day per engine H.P.
Camps equipped with modern conveniences	1 bbl. per capita.

Note—The quantity of water required for the slush pits will vary greatly with the locality and the thief sands drilled, but the above may be taken as average figures. The large slush pits common in the Mid-Continent require as much as 3,000 bbls. of water to fill them before spudding.

Sources of Supply

The water is usually obtained from one of the following: Rivers or other streams, impounded surface waters, deep sand wells, shallow gravel wells and water mines.

If there is a stream or river of sufficient capacity and not too distant it usually offers the most satisfactory source of supply. Figures on the amount of water that can be withdrawn during the different seasons can generally be estimated from the United States Geological Survey water supply bulletins, issued by the Department of the Interior or from similar bulletins issued by state agencies, such as the state geological or agricultural departments. Samples may be taken and analyzed for hardness and bacteria, and a suitable treating plant may be designed to condition the water for the desired service.

For a river station the general practice is to sink pits in the river bed and lift the water with centrifugal well pumps, delivering into reservoirs or tanks from which it may either be treated and pumped to the field, or pumped to the field and there treated as required.

Impounded water collected in natural lakes and ponds, or backed by dams, is sometimes available, but except where operations are on a very small scale such water is seldom of importance as a source of supply, since it is liable to rapid exhaustion in times of drought. The water is usually handled by force pumps taking suction direct from the body of the water. Where impounded water is relatively soft, this type of water supply within its limits is economical and satisfactory. The drainage area or water shed should be free from calcium and magnesium salts to insure absolutely soft water and as this is not the case in the Mid-Continent, it follows that surface water is generally hard. Where a stream can be dammed economically and where the terrain is favorable, a large volume of water may be impounded with a fair knowledge of what hardness to expect. Artificial reservoirs in flat countries are liable to be costly and large evaporation losses may occur; the cost is usually disproportionate with the cost of obtaining water from other sources, although for wildcat tests reservoirs are generally used.

Deep Sand Wells

Deep sand wells ranging in depths from 100 to 1,000 feet may be drilled to supply considerable quantities of good quality water. A certain amount of testing is usually required to determine the production that may be expected, but in many cases preliminary information can be obtained from contractors, municipal water superintendents, industrial plants and railway water engineers. In the Mid-Continent Field it is general practice to drill these wells with standard tools, making a 10-inch hole to accommodate the 8⅝-inch outside diameter casing, or an 8⅛-inch hole to accommodate the 6⅝-inch outside diameter casing. The final string of casing is cemented with 10 to 50 sacks of cement on top of the water horizon and the well drilled through the water producing sand. Contractors may be employed in the major fields to drill this type of well for prices ranging from $1.50 to $3.50 per foot, with the company furnishing fuel, water and casing. The equipment for producing water wells usually depends upon the power available. Where the fluid levels are of sufficient height to permit the efficient use of air lift, this method offers an economical and practical way of lifting large volumes of water. A typical air lift installation for a 650-foot water well consists of 4-inch tubing run to the top of the producing horizon with a 1¼-inch air conduction line run inside it to a depth of approximately 25 feet from the bottom of the 4-inch tubing. Some operators use a return bend on the bottom of the air line, but it has been found in practice that particles of scale and floating sand lodge in the openings and settle in the bottom of the return bend. Using between 200,000 and 250,000 cubic feet of air per day at a working pressure from 80 to 100 pounds per square inch, wells of the above depth have been known to produce as much as 2,400 bbls. of water per day. A portable air compressor of sufficient capacity to make the above delivery of air costs approximately $4,000 and operating expense may be expected to average around 6 cents per 1,000 cubic feet of air.

Other methods of producing 100 to 1,000-foot water wells include common oil well pumping equipment, using rods and tubing with a working barrel at the bottom of the well, and a jack or a steam piston at the well head. In general, the usual equipment available decreases in capacity very rapidly with increasing depth, and in all cases is limited by the tensile capacity of the rods. It is general practice to use 3 or 4-inch tubing and five-eighths or three-fourths-inch rods.

Recent development in equipping water wells has demonstrated the advantages of completing the well with a string of 10¾-inch outside diameter casing, perforated opposite all the water sands penetrated while drilling to the total depth, and using a 7-inch outside diameter conductor pipe at the bottom of which is installed a multistage centrifugal pump, operated by a motor at the surface through a shaft centered in the 7-inch casing. In water sands of large potential capacities this type of pump has been used to lift as much as 5,000 bbls. of water per day. A typical installation of a 650-foot well would consist of a 40 horsepower, 1,200 r.p.m., 3-phase, 60-cycle motor, installed on the well head and coupled to a 1½-inch cold rolled shaft connected to the pump unit at the bottom of the well. The pump has 20 to 25 stages and is rated at approximately 155 gallons per minute at 40 per cent efficiency. The price of this equipment will range from $4,000 to $4,500. After an initial test to determine the drop in the fluid level in the well while producing, changes can be made to establish the most efficient working depth.

Shallow Gravel Wells

Shallow gravel wells have been sunk in the Mid-Continent Field using a clam shell bucket operated by a small gasoline hoist and portable rig. During digging the clam shell is followed by 34 or 36-inch cassions which are afterward gravel filled around an 18-inch perforated casing and the cassion is pulled. When the sand is 20 feet or more thick the spacing between the wells of this type should be 220 feet to 250 feet on staggered locations across the underground water course. Gravel wells 50 feet in depth have been completed in the old channel of the North Canadian River near Oklahoma City with initial production as high as 20,000 bbls. per day, but such wells should not be produced at a rate greater than 60 per cent of potential. The pumping equipment for this type of well may consist of a 20 horsepower, 440-volt, 3-phase, 60-cycle, 1,725 r.p.m. motor installed at the well head, connected to a 1½-inch shaft on which is mounted a three-stage centrifugal pump rated at 600 gallons per minute against a 70-foot head. The cost of the motor, water conductor pipe, shaft and centrifugal pump will range from $1,300 to $1,500 for a 50-foot well. Construction costs vary from $20 to $25 per foot, exclusive of the casing and pumping equipment.

In order to increase and maintain production from water sand wells a special process has been used in which a large gravel filled cavity is formed in the water horizon[1]. The well is operated by air lift and as sand is produced with the water it is replaced by gravel fed from the surface. The tendency of the sand to pack is overcome by periodically reversing the direction of the flow.

In some fields a water supply has been developed by means of water mines.[2] These consist of a shaft sunk to the water horizon (previously tested by core or drilled holes) at the bottom of which a drainage chamber is dug and (or) lateral tunnels driven out into the formation for the purpose of increasing the drainage area.

Transportation

The design for pipe lines for water follows rules which are now well established and space will not be taken here with discussion of distribution systems. The same thing holds with regard to pump stations, but the selection of the equipment will depend to some extent upon the pumps immediately available. For oil well drilling programs the water distribution system usually proves inadequate and the final cost far exceeds the estimate because of the necessity of laying duplicate lines.

Benefits of Water Treatment

Water treatment for the removal of suspended matter and hardness is an operation which has been almost universally employed in established industrial plants for many years, but notwithstanding the advantages of treated water over untreated water, water treating methods have not been widely used in oil field operations, with the possible exception of gasoline plants. The practicability of water treatment for modern oil fields is dependent upon the benefits to be derived. Some of these benefits which are definite aids to oil field operations will be discussed.

Water treatment eliminates suspended matter and thereby permits better operation of pumps, due to longer life of the packing and less erosion of the working parts. Elimination of mud allows a larger volume of water to be pumped through the lines and decreases the operating cost by the amount of power which would have been required to force the mud to the point where the water is used. A pump handling treated water will require less horsepower and will have a higher efficiency than one handling a turbid water. In order to reduce installation costs it is customary to use a small line and high operating pressures of 200 to 500 pounds per square inch. With these high operating pressures anything that obstructs the flow of water increases the pressure, for any given volume of water. Without treatment the flow of water is restricted by scale deposits in the line, which reduce the cross sectional flow area, and by corrosion, which causes a rough surface on the inside of the pipe. Ordinary waters, due to their dissolved oxygen content often cause corrosion of steel pipe, which is almost negligible with lime soda treated water. A case is on record in which the corrosion of the water line caused an increase in operating pressure from 525 to 750 pounds at which pressure the line failed by rupture. By the use of treated water the life of the line may be doubled or tripled due to decrease in corrosion and elimination of danger from failure due to perforation.

Benefits of Treating

With treated water the packing on boiler feed water pumps gives less trouble, the formation of scale in boilers is eliminated and the tendency of the boiler water to foam and prime is reduced. This results in a saving in the amount of gas and water required for boiler operation; after water was softened, one Mid-Continent company reported a decrease of 25 per cent in fuel and 20 per cent in water required for the operation of drilling boilers on its leases.

Faulk, in an Ohio State Geological Survey bulletin, discusses the causes of foaming and shows definitely that with a low amount (less than 30 grains per gallon) of soluble salts and a high amount of suspended matter, or vice versa, foaming will not occur. When the suspended matter does not exceed about 30 grains per gallon, as much as 1,000 grains per gallon of soluble salts are required to cause foaming. When either of these substances is increased above 30 grains per gallon, the presence of large amounts of the other will produce foaming. Elimination of foaming improves the lubrication and decreases the erosion of pistons.

The use of treated water decreases the

*Prepared under direction of Mid-Continent district committee on drilling practice, division of production of the American Petroleum Institute; W. K. Whiteford, K. A. Covell, John T. Hayward, C. P. Parsons, A. W. Thompson. Presented at eleventh annual meeting, Chicago, Ill.

[1]Air Made Well Co., Bulletin No. 56-J.

[2]"New Technique in Developing Water," L. G. E. Bignell, The Oil and Gas Journal, December, 1929.

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repairs necessary to keep a boiler in good condition, the possibility of corrosion is reduced and overheating of various parts of the boiler because of scale is eliminated. Boilers can be operated for the entire period of drilling a well without the necessity of a shutdown for cleaning when properly treated water is used.

Engineering Experiment Station Bulletin No. 1 of the University of Illinois reports the following losses in fuel efficiency due to the presence of scale in boilers:

TABLE 1

Character of scale	Thickness	Composition	Loss of efficiency (%)
Hard	1/60"	Mostly carbonate	9.4
Soft	1/23"	Mostly carbonate	7.2
Hard	1/32"	Mostly carbonate	8.5
Soft	1/25"	Mostly carbonate	8.0
Hard	1/25"	Mostly sulphate	9.3
Hard	1/20"	Mostly sulphate	11.1
Soft	1/16"	Mostly sulphate	10.8
Soft	1/16"	Mostly carbonate	11.0
Hard	1/16"	Mostly carbonate	12.4
Hard	1/16"	Mostly carbonate	12.6
Soft	1/11"	Mostly carbonate	15.0
Hard	1/8"	Mostly sulphate	15.9

The presence of a large amount of caustic soda in the absence of sodium sulphate introduces the probability of hydrogen embrittlement of the boiler metal.[3] Caustic soda in the boiler comes from the introduction of soda ash which, under the temperatures and pressures encountered, decomposes in part to caustic soda. All sodium bicarbonate and all soda ash in the water must be considered potential caustic soda. The soda ash is obtained in two ways. There are some natural waters containing large amounts of sodium bicarbonate, and waters high in calcium and magnesium bicarbonate when softened by zeolite produce a corresponding amount of sodium bicarbonate. A water containing 21 grains per gallon temporary hardness when softened by the zeolite will introduce 3 pounds of soda ash per 1,000 gallons of boiler feed water. In lime-soda ash softening a large excess of soda ash in incorrectly treated water will produce similar results. Embrittlement has never occurred when the sulphate-carbonate ratio is sufficiently high. It is sometimes quite difficult to maintain the proper ratio so sodium phosphate is used and being about 500 times as efficient as the sulphate, a very small quantity is needed. The usual sulphate-carbonate ratio to be maintained is:

TABLE 2

Operating pressure—	Sulphate	Carbonate
150	1	1
200	2	1
250 or above	3	1

Mud-Laden Fluid

The properties of a mud-laden fluid are somewhat dependent upon the water used in mixing.[4] Parsons has shown that in the absence of interfering substances, clay particles reach a state of maximum dispersion in a fluid having a pH value above 9 (slightly alkaline). The pH value of lime treated water is usually between 9.0 and 10.6, indicating that this water would be ideal for use in the preparation of drilling fluid. The pH value is expressed as the characteristic of the log of the reciprocal of the hydrogen ion concentration and is a measure of the "effective" rather than the "total" acidity or alkalinity.

In securing best performance and maximum efficiency from gas engines it is essential that cooling water be used which is nonscale forming and noncorrosive. Where gas engines are used for pumping a well the horsepower of each engine seems rather unimportant, but when the total number of small engines used in pumping the wells on a company's entire lease in the field is considered then the total horsepower becomes a very significant item. The cost of the cracked heads alone will probably pay for the cost of the treatment.

It is also necessary to have a nonscale forming water for use over condensers and cooling coils in a spray tower; any scale on the condenser or cooler tubes will result in a lower heat transfer rate. Water passed over a cooling tower is always saturated with oxygen so that there is a maximum tendency toward corrosion. The only way to eliminate this corrosive effect is by the formation of surface films on the metal, as with sodium silicate or sodium chromate, or the maintenance of a high pH value (high alkalinity) as with lime treated water. The formation of an algae growth in cooling towers interferes as much with heat transfer as a scale formation of similar thickness, also algae will frequently clog the cooling tubes. Algae can be eliminated by the use of copper sulphate or chlorine gas.

The question is quite frequently brought up as to whether it is better to treat all the water supply at a central pumping station or to install individual softeners at the point of use. The central station treating plant costs considerably less to install than the large number of small plants. Only three or four men need to be trained in water treatment for the central station plant while for the plants at individual points, wells, and gasoline plants, each must have its own set of operators so that a much larger number of men must be taught the intricacies of handling water softeners, and it is obvious that there will be many more cases of incorrectly treated water with the individual softeners. The central operator can handle the treatment of 50,000 bbls. of water per day almost as easily as 5,000 bbls., so that the total man-hours required to produce a given volume of water will be very much less with the central station. There will be uniformly treated water all through the system with the central station operation instead of water of varying hardness that would probably result from the use of a number of different installations with different operators. If the water is treated in a central station then it is more attractive for sale to other companies. Probably the only important item in favor of the use of individual softeners is that it permits the use of treated water at points where it is needed most and eliminates the cost of water treatment for places where the operator would prefer to put up with the difficulties attendant upon scale and mud rather than pay his proportionate cost of treatment of the entire supply.

Treating Methods

Lima-soda ash softening—The addition of lime to hard water will reduce the temporary hardness to about two or three grains per gallon and will convert all of the magnesium salts to calcium salts. It will also convert any sodium bicarbonate present into sodium carbonate. If there is any permanent hardness present in the water it will be completely removed by the addition of soda ash. These reactions proceed rather slowly at atmospheric temperatures and are particularly slow in cold weather. The addition of an excess of about one or two grains per gallon of the chemicals will hasten the reactions so that they are nearly completed in 20 to 30 minutes. The precipitate formed settles rather slowly so that a tank having a four-hour holding capacity is ordinarily required for this method of softening and it is not unusual to use tanks of six to eight hours' capacity. The addition of sodium aluminate completes the reaction and forms a larger flock, thus effecting better settling. The settled water is filtered and should possess the following characteristics:

1. Clear and colorless.
2. Hardness not to exceed three grains per gallon.
3. Alkaline, its pH value ranging from 9.3 to 10.6.

A type of equipment that will supply water with these characteristics consists of a deviee to feed the chemicals in proper proportion to the flow of water, a large settling tank containing a small downtake or reaction tube, and pressure filters. The water enters at the top of the reaction tube and is there mixed with the chemicals. The reaction takes place as the water flows downward through the reaction tube and as the water turns upward and across the tank to the outlet the precipitate settles to the bottom of the tank where it is drawn off periodically through a perforated pipe spider connected to a quick opening sludge valve.

Essentially the same equipment is required for clarification of waters that are turbid but do not contain sufficient hardness to justify softening. The chemicals usually employed in this case are aluminum sulphate, lime, sodium aluminate, iron sulphate or various combinations of these.

Chemicals Required

The amounts of chemicals required for softening for each 1,000 grains hardness removed are as follows:

.12 pound hydrated line for temporary hardness due to calcium
.24 pound hydrated line for temporary hardness due to magniesium
.12 pound hydrated lime and .16 pound soda ash for permanent hardness due to magnesium
.16 pound soda ash for permanent hardness due to calcium

The amount of chemicals added is controlled by testing the hardness of treated water with a standard soap solution and by titrating the treated water with standard acid solution using phenolphthalein and methyl orange as indicators. The various relations of these three tests show what changes in chemicals are necessary in case the treatment is not correct.

This type of softening is applicable to any water so that equipment installed for temporary use at one location can always be used at another location regardless of the chemical characteristics of the new water.

Lime-soda ash treated water has the

(Continued on Page 162)

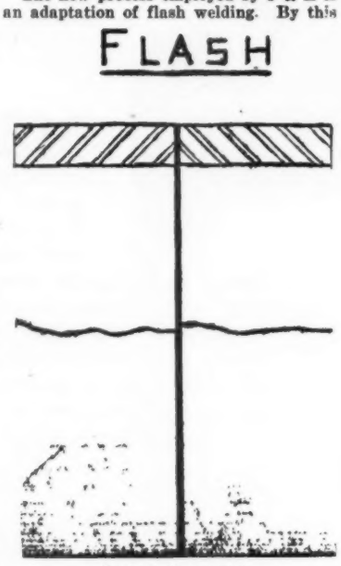
[3]The embrittlement of boiler plate—Mech. Engr., July, 1923, by S. W. Parr and Frederick G. Straub.

[4]C. P. Parsons, "Characteristics of Drill Mud Fluids," October, 1930, A.I.M.E., Tulsa, Okla.

ADAPTATION OF FLASH WELDING OF PIPE ANNOUNCED BY J & L

Following exhaustive research, the Jones & Laughlin Steel Corp. has developed and is now using exclusively an improved type of welded joint on all J & L double length line pipe in sizes from 1 inch to 12 inches inclusive to meet the increasing demand for oil and gas line pipe in double mill lengths.

The new process employed by J & L is an adaptation of flash welding. By this method of joining steel, the parent metal in the parts to be joined is electrically heated to the point of fusing under pressure. No foreign material is required to form a bond. The nature of the weld is such that the J & L adaptation of this process results in production of a single, homogeneous pipe of the combined lengths of the two parts joined.



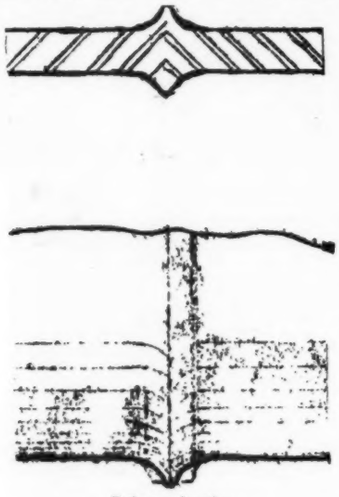
At start of operation.

When this corporation began the production of double length welded pipe about two years ago, it employed the acetylene welding process that was in general use in the industry at that time. J & L operating officials began studies and experiments, involving considerable expense, and starting on the basis that the best joint between two pieces of metal is secured by forging, this corporation directed its study toward producing the equivalent of a forged joint. These efforts culminated in the adaptation of the electrical process of flash welding, because it gives the desired forging characteristics.

With the acetylene process, the pipe is beveled on the ends and then placed in a straight line with the beveled edges separated by a short gap. The space formed by the gap and the beveled area is filled by melting a wire of special composition in an acetylene flame. The wire, so melted, forms a bond which is allowed to rise above the pipe surface in the form of a pad in order to give adequate strength to the joint. The metal accumulating on the inner surface of the pipe is trimmed off. After inspection and hydrostatic test, the pipe, so far as the weld is concerned, is then ready for the trade.

Flash Welding Method

In the flash welding process, the pipes to be joined are butted together. Heavy electrical contacts are clamped around each pipe close to the abutting ends.



Before trimming.

Electric current of high amperage is transmitted between these contacts through the joint until the ends become molten hot. At this stage, applied pressure squeezes the molten metal from the joint, as well as any oxide that forms during the welding operation and at the same time unites the pipes in a manner

After trimming.

(Continued on Page 162)

INSURE Continued Accuracy of Your Recorders and Pyrometers

Dubbs Units Instrument Board, Continental Oil Co., Ponca City, Okla.

..use HILLS-McCANNA

SOCKETS *and* TUBES

The alloys used for Hills-McCanna Sockets and Tubes are very sensitive to temperature changes. Accurate recordings are thereby assured. Though a tube several inches in length may be required, Hills-McCanna's are smooth of bore and accurate, permitting safe stem insertion or withdrawal.

Hills-McCanna Sockets and Tubes are made in a variety of metals according to the service required and in many sizes and types.

It will pay you to use them.

HILLS-McCANNA CO.
2351 Nelson St.
CHICAGO

Field Problems and Their Solution

EDITED BY THOMAS F. SMILEY

In order that men connected with the drilling, producing and transporting branches of the petroleum industry may procure quickly a solution of many problems confronting them from time to time in their work, The Oil and Gas Journal has arranged with leading engineers and other recognized authorities to answer questions submitted by readers of this publication pertaining to the work of drilling and producing crude oil and transporting this product.

Everyone is invited to submit questions freely. These questions will be submitted to proper authorities by Mr. Smiley, who edits the page, and answers, based on the best available information, will be published. Each question should give as much detail as possible, especially where it relates to matters where depths of sands, types of sands and operations on adjoining properties would have a bearing on the problem involved. The source of all questions will be considered as confidential and only initials will be published in connection with the question.

In this connection, The Oil and Gas Journal will be glad to publish articles from field men who have devised new methods or practices which are improvements.

In case an immediate answer is important, one will be given by mail if the writer requests it.

WHAT IS GOOD ROTARY MUD?

Is there some sort of standard that will enable a rotary driller to know when he has the best possible rotary mud? In talking with other drillers it seems to me that each man has his own ideas about it. They can't all be right, but it does seem as though some of them must be nearer right than others. If there is any kind of fixed rule to follow in mixing the circulating mud I would like to have you tell me.—E. E. S.

Before going into the matter of how best to mix rotary mud it may be well to note what duties the mud is designed to perform. These duties include first of all carrying the cuttings out of the hole to settle out in the circulating pits; second, plastering the wall of the hole and thus sealing off gas, oil or water sands; third, serving as a lubricant in the hole and cooling the cutting tool. In addition it should exercise a cohesive effect on loose formations, thus tending to keep them from working off and dropping into the hole, and it should be heavy enough to hold solids in suspension whenever circulation is stopped temporarily. In its function of keeping gas, oil and water sands sealed off hydrostatic pressure plays an important part, and this hydrostatic pressure is governed by the volume and weight of solids in the mud.

In order to fulfill its purpose most effectively, the drilling mud then must be of the right density and viscosity. It must be able to penetrate sands encountered and it must be circulated easily by the slush pumps.

You are probably right in your statement that many rotary drillers do not give careful consideration to the consistency and quality of their drilling mud. R. S. Cartwright, an expert in the field, is authority for the statement that differences as high as 3 pounds to the gallon have been found in the muds used in the same field and under virtually the same conditions. This is clear evidence of the hit-or-miss methods that often prevail.

No definite standard has been established for the weight or viscosity of rotary mud and as a matter of fact no standard could be fixed that would applyply to all fields, since the requirements of different fields vary. Drilling authorities seem to agree that a mud weighing about 10 pounds to the gallon generally gives satisfactory results. Indicating, however, the impossibility of laying down a rule that can be followed blindly is the fact that a mud weighing 14 pounds to the gallon has been found to give the best results in the Hobbs Field of New Mexico.

You will find information of value to you in this connection in the following articles which have appeared in The Oil and Gas Journal: "Proposed Improvement in Mud Making," June 12, 1930, and "Mud Problems Now Receiving Attention," October 16, 1930, both by L. G. E. Bignell; "Admixture of Rotary Mud," June 12, 1930, and "Characteristics of Drill Mud Fluid," October 16, 1930, both by C. P. Parsons; "Properties and Treatment of Drill Mud," October 16, 1930, by Hallan N. Marsh.

QUICKSAND CAUSES TROUBLE

Sand in this region is giving us a lot of trouble in building derricks on solid foundation. There is not much difficulty in dry seasons and we have used concrete piers for the derrick and for the pump and engine. But high water from the river soaks this sand and turns it into a regular quicksand, so that these piers sink, and it looks as though some of our derricks might topple over. I wonder if the same kind of conditions have been encountered in other oil fields. If they have can you tell me how they have overcome the trouble?—S. N. D.

A number of methods have been used in different pools where it has been advisable to drill in that portion of the field that lies under water or in a quicksand bed and they are based upon getting as much material under the derrick corners and pumps and engines as possible so that the weight may be distributed over as large an area as possible.

Quicksand and alluvial soils have a bearing power of about 0.5 ton per square foot minimum and 1 ton maximum, or an average of about three-quarters of a ton per square foot of bearing area.

As it is a well-known fact that vibration will sink an object into quicksand rapidly and there is a constant vibration in a drilling rig it is necessary that the load be carried in a manner that will distribute this vibration as much as possible.

In some fields it is the practice to lay down a mat made of heavy timbers and then build up the derrick corners on it. Others will make heavy timber trusses that will extend from one corner to the other and in this way distribute the load.

Cribbing is sometime formed and inside the box rock and sand is dumped until new ground is formed upon which the derrick and other equipment can be built.

Piling is driven into the sand and the derrick erected upon heavy base members that are placed on top of the piles. If the piles are driven to bed rock this method is satisfactory but if the piling does not reach solid foundation, vibration will tend to force it further into the wet quicksand and throw the whole structure out of line.

In the Oklahoma City Field they are using a novel foundation devised by L. B. Holland, engineer for the Phillips Petroleum Corp., together with E. M. Carter, hydraulic engineer, and this is quite fully described in an article in The Oil and Gas Journal, July 10, 1930. Sketch of the general plan is given with this article.

BLEEDING THE SHELL

"Bleeding the shell" is recommended by one writer in cases where a shell filled with nitroglycerin gets stuck in the well. Although I never came across the expression before, it suggests to my mind the operation of removing the explosive from the shell while it is in the hole. Is that what it does mean? If it does, how is the nitroglycerin thus emptied into the well kept from being a menace after that?—L. E. G.

In his paper on "Use of Nitroglycerin in Oil and Gas Wells," C. O. Rison states:

"Loaded shells sometimes lodge in the open hole and in such cases when the shells contain liquid nitroglycerin, they must be 'bled' so they can more safely be fished out. In bleeding the shell a sharpened tool, like a polish rod, is lowered on the sand line to pierce the shell. This allows the explosive to run out and settle through the fluid to the bottom of the hole. The practice of using a muffled bailer to shove down a shell which has become lodged in the hole is dangerous and should be discouraged."

W. H. Jeffery in his book on "Deep Well Drilling" gives practically the same advice and states that to "muffle the bailer" a block of wood is fitted around the bailer dart but he does not recommend this practice and recommends that the shell be bled first.

As nitroglycerin has a specific gravity of 1.60 at 15° C. and is not hygroscopic (will not absorb moisture) it will sink in the fluid in the hole and when the new shot is discharged this loose nitroglycerin will be detonated and destroyed. This is about the only safe way of removing this loose nitroglycerin from the hole for to bail or pump it out would be dangerous.

WHY WAS IT CALLED THAT?

LOG

This term obviously was taken from the sea, for on shipboard a log is a floating contrivance for measuring the vessel's rate of motion and the name is applied also to the record of speed thus obtained. From early days in the oil field it has been a practice to record the progress made in drilling a well and the character of the formations penetrated. Many seafaring men were employed in drilling wells for oil or brine in the early days and it was natural that they should apply to the drilling record the word they knew for the ship's speed record. So "log" it became.

WHY OIL TEMPERATURE DROPS

The temperature of crude oil is said to go down between the time it starts from the sand and the time it reaches the top of the hole. What causes this drop in temperature? How much difference is there between the temperature of the crude at the bottom of the well and its temperature at the top?—F. E. E.

It is a demonstrated fact that the temperature of crude oil drops as it rises from the reservoir sands to the top of the hole. The degree of difference depends upon existing conditions. The decreased heat is caused in part by expansion of the gas which accompanies the oil and in part by the cooling effect of the upper formations. The most important influence, however, is that of the expansion of the gas.

In a flowing well in Texas, 3,389 feet deep, the gas pressure was 325 pounds per square inch, and the temperature was 124° F. at the bottom, but at the casinghead, where a pressure of 50 pounds per square inch was maintained, the temperature was 82° F. In another Texas well the temperature of the oil and gas at a depth of 2,899 feet was 127° F. and the pressure was 310 pounds per square inch. At the casinghead where the pressure varied between 10 and 25 pounds per square inch, the temperature of the oil and gas mixture was 86° F., or 41° less than at the bottom.

Production tests on wells in the Salt Creek Field, Wyo., showed a relation between fluid temperature at the well head and gas-oil ratios. The tests indicated that temperatures at the casinghead are higher usually when gas-oil ratios are low than when large excesses of gas are produced with the oil. When the volume of gas accompanying the oil to the surface is greatly in excess of that required for efficient flow, large volumes of gas expand in the flow tube without doing a corresponding amount of useful work. This expansion causes increased cooling of the rising mixture and results in a lower temperature at the well head than if gas-oil ratios had been lower.

EXPERIMENTS WITH ALUMINUM

Experiments with aluminum were going to be made to see if it could be used to prevent corrosion of storage tanks, according to something I read several months ago. This is a subject in which I am interested. Could you tell me something about how these experiments have been carried on and what results have been gained?—M. H. S.

It has long been known that aluminum would not make any permanent combination with sulphur in any of its forms and it therefore was reasoned that to handle oils and gases containing hydrogen sulphide or any sulphur compound aluminum tanks, pipes and equipment would be ideal.

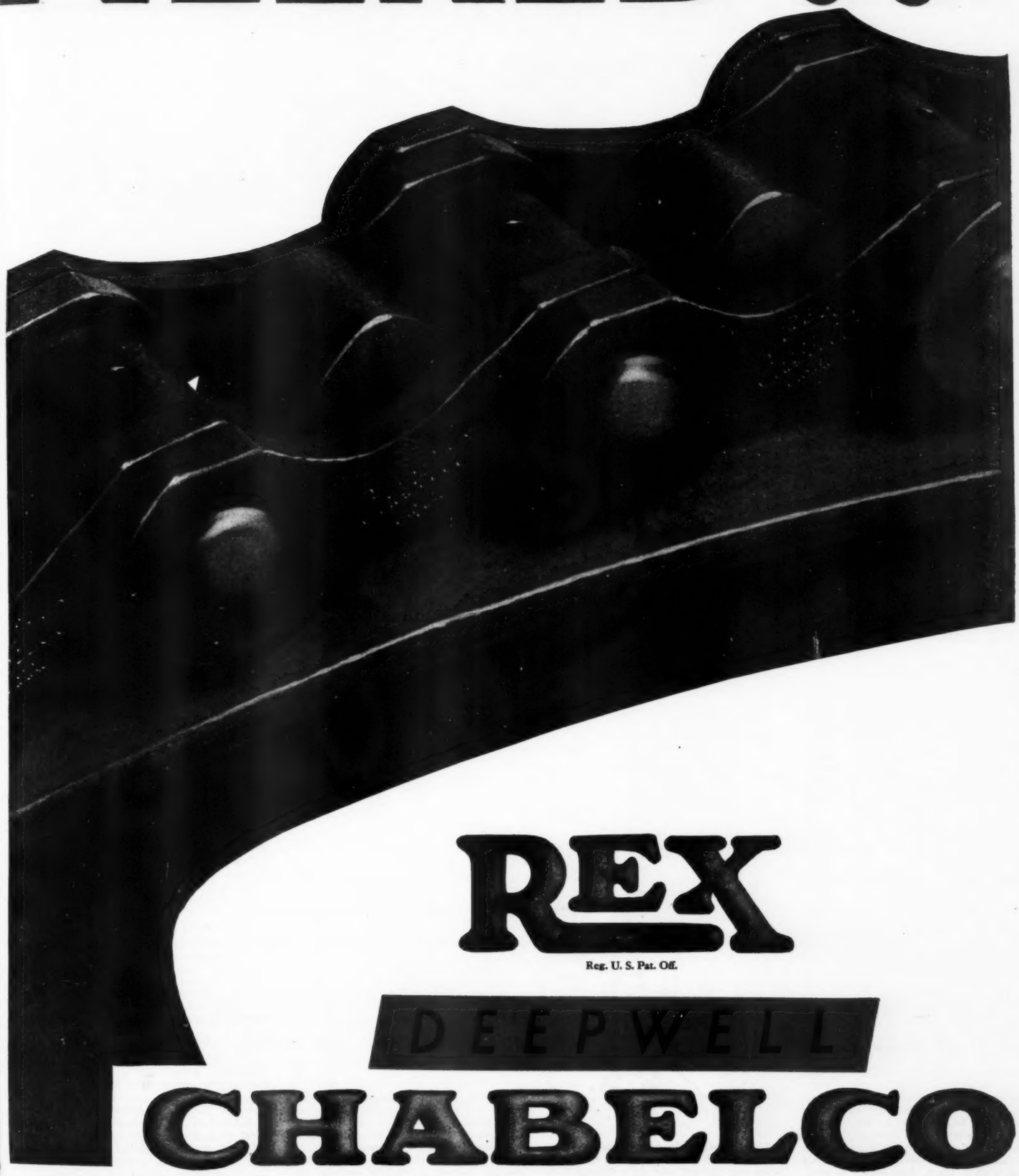
This theory was tested in a practical way by installing tanks made of sheet aluminium in the Crane County field of West Texas, and also in the Panhandle area of north Texas where corrosion of steel tankage was rapid. A new 1,000-barrel all-aluminum tank has recently been installed on the property of the Big Lake Oil Co. at Big Lake, Texas, to handle oil from that field which has been found highly corrosive of all-steel equipment.

The results experienced in the West Texas test are said to have justified the claims made for aluminum, for the test tank was in use over 18 months handling oil and hydrogen sulphide gas and is reported to have been in a good state of repair at the end of that time.

Handling waters that were high in magnesium and sodium salts and heated to high temperatures in aluminum tanks resulted in the aluminum going into solution and destroying the tanks. This, however, does not detract from the evidence obtained in Crane County, Texas, and it is predicted that aluminum tanks will find wide use in handling hydrogen sulphide and sulphur oils on leases where corrosion of steel tanks is excessive.

Full reports of the tests have been carried in The Oil and Gas Journal from time to time and the result of the installation of the new tank at Big Lake field will be followed and reported on as results are available.

NEERED . .



REX

Reg. U. S. Pat. Off.

DEEPWELL

CHABELCO

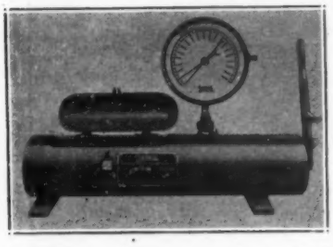
Oil Field Equipment and Supplies

DEVICE TESTS WELDS AS SOON AS THEY ARE MADE

Oxweld Acetylene Co., 30 East Forty-second Street, New York, announces the Oxweld portable tensile testing machine, designed to facilitate the testing of welds in the field or shop. This machine was developed in co-operation with Union Carbide & Carbon Research Laboratories, Inc., and, having passed service tests is being sold as a standard piece of Oxweld equipment.

The machine weighs 165 pounds. It is 28 inches in overall length and 6¾ inches in maximum diameter. It is a self-contained, totally enclosed unit. When closed for shipment, there are no projections and the machine presents a comparatively smooth cylindrical surface. The accompanying illustration shows how the machine appears when open and ready for making tensile tests.

The machine consists of a tubular compression member with a set of grips in the head and a hydraulic cylinder block in its base. The cylinder block contains a communicating pump and cylinder directly machined into a single block, and



the cylinder pressure operates a piston carrying a second set of grips.

The specimen to be tested is placed between the jaws, which have spring grips. The release valve is closed and the pump handle, applied at the end of the cylinder, is moved back and forth. A set of conical blocks has been constructed to fit into the machine head in place of the grips so that the standard one-half-inch diameter round specimens may be tested if desired. The load is measured directly in pounds per square inch by a calibrated pressure gauge actuated by the pressure in the cylinder.

This machine makes it possible to obtain a tensile test result immediately after welds are made. This is particularly important in connection with qualification tests for determining welders' ability. It also facilitates making periodic check tests of the operators and in many cases provides a ready means for testing sections cut at random by the inspector from completed work.

WIRE ROPE HANDBOOK ISSUED

The E. H. Edwards Co., manufacturer of wire rope in San Francisco, has just completed a pocket-size 192-page wire rope handbook. The book was prepared from the practical angle of everyday questions that wire rope users ask. In addition to the standard information on construction, size, breaking strength, list price, etc., this handy book contains data on the use of wire rope in the field. This information is conveniently divided and indexed into sections such as "Logging," "Oil Field," "Mining," etc. What should be expected of wire rope? How do lines act under certain conditions and why? What can be done about it? How many lines should be strung up and when should they be taken off? What is the life of wire rope and how prolong it? These are a few of the problems treated. The book is round-cornered and firmly bound with a black cloth cover to withstand usage in the field.

ADJUSTABLE BRACES ABSORB DRAWWORKS VIBRATION

Blackwell & Sunde, Inc., of Long Beach, Calif., manufacturers of the B & S adjustable rig braces, say that through the use of these oil-country devices the vibration which accompanies the operation of a rotary drilling rig is absorbed as fully as this is possible. Virtual elimination of this objectionable feature of rotary drilling is accomplished, according to Blackwell & Sunde, through application of the ball-and-socket principle. Each end of the brace is a true ball-and-socket joint, so that regardless of the position in which it may be placed a thrust from any angle is absorbed.

The B & S adjustable rig braces are of all-steel construction and they are said to be easily installed or removed. Each casting in the assembly is made from specially alloyed steels, making the braces strong and long-lived.

A folder in two colors describing and illustrating these rig braces has been prepared for distribution among those interested in rotary drilling, and copies or it may be obtained by sending a request to Blackwell & Sunde, Inc., 3135 Cherry Avenue, Long Beach, Calif.

AMONG THE EQUIPMENT HOUSES

William J. Siedentopf, who until recently was connected with the main office of the Pittsburgh Equitable Meter Co. in Pittsburgh, Pa., has been transferred to the Dallas, Tex., office.

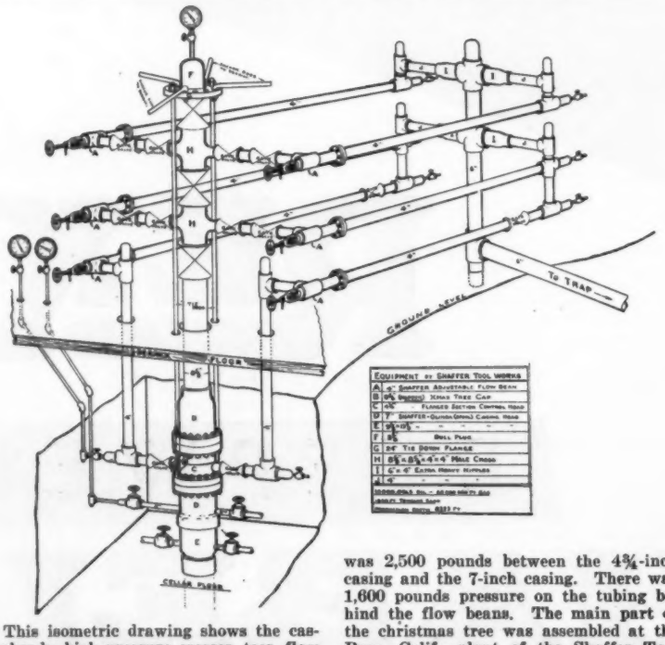
E. R. Galvin, general sales manager of the Caterpillar Tractor Co., Peoria, Ill., is making a trip through the Southwest, accompanied by H. B. Brothers, district representative in San Antonio, Tex., and P. R. Ferrell, district representative in Dallas, Tex.

A survey covering practically every oil field in the world has been completed by W. W. Cole, manager of foreign sales for the Byron Jackson Co. The trip took more than a year. Most foreign operators, Mr. Cole said, have the modernizing of their equipment in mind at all times. Field executives were found to be remarkably up to date in their knowledge of late developments.

The Coppus Engineering Corp., Worcester, Mass., has appointed G. H. Bolle district representative in New York territory with headquarters at 120 Liberty Street, New York.

A. H. Shafer has been appointed manager of the Foxboro Co.'s Pittsburgh office, replacing H. S. Gray who is now in charge of office routine at the home plant.

KETTLEMAN HILLS HOOKUP WITH SHAFFER EQUIPMENT


TO TRAP
GROUND LEVEL
CELLAR FLOOR
EQUIPMENT BY SHAFFER TOOL WORKS
A 6" SHAFFER ADJUSTABLE FLOW BEAN
B 6" FLANGED TYPE CAP
C 10" FLANGED SECTION CASING HEAD
D 7" SHAFFER-CLUTCH (OPEN) CASING HEAD
E 10"x10" -
F 8" BULL PLUG
G 24" TIE DOWN FLANGE
H 8"x8"x4"x4" MALE CROSS
I 4"x4" EXTRA HEAVY NIPPLES
J 4" -

This isometric drawing shows the casingheads, high pressure crosses, tees, flow beans and flanges used on a famous Kettleman Hills well. The initial pressure was 2,500 pounds between the 4¾-inch casing and the 7-inch casing. There was 1,600 pounds pressure on the tubing behind the flow beans. The main part of the christmas tree was assembled at the Brea, Calif., plant of the Shaffer Tool Works, tested to 6,000 pounds and shipped to the well.

BRAKEBLOKS HELP SOLVE NEW BRAKING PROBLEMS

American brakebloks, made from a new friction material, are said to go far toward solving the problems of oil well braking that have developed with deeper drilling. American brakebloks, a product of the American Brake Materials Corp., a division of the American Brake Shoe & Foundry Co., are bonded by a compound which is changed to a solid in the process of manufacture, and according to the manufacturer it cannot be softened or volatilized even by the blistering heat generated in oil well braking. This heat resisting feature is of importance to the driller. The manufacturer says it means that brakebloks will not burn; that they will wear evenly, maintaining a constant coefficient of friction; that they will not soften or tear loose from the bands; that they will not swell and close up clearances; that the crew need never resort to gas masks for there is no dust or smoke.

American brakebloks are said to keep brake flanges true and smooth. They are noncompressible and do not crawl or curl over the edge of the brake band. They have no metallic content to score the flanges. They are shaped to fit the radius of the flange; and if, in changing bands, care is taken to keep the band from being pulled out of shape with the catline, brakebloks are said to wear evenly all the way around, eliminating costly delays made necessary by having to change a band which is worn through in one spot.

Because of their reported ability to hold the load at every depth, American brakebloks are said to help prevent crooked holes. They do not grab, but permit the driller to reel off his line evenly. They have no audible vibration period of their own and are said to act as a deadener for other brake noises.

TRADE LITERATURE RECEIVED

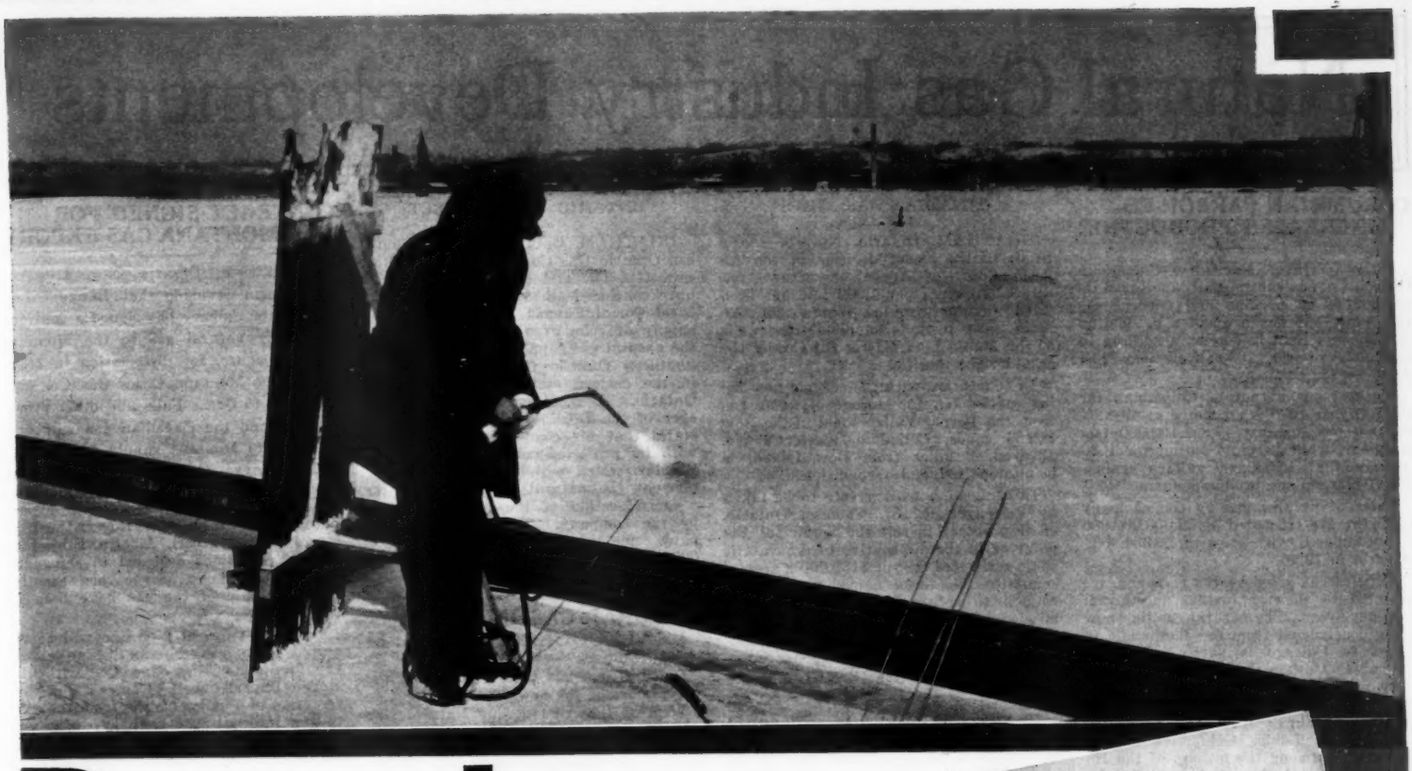
The Deister Concentrator Co., Fort Wayne, Ind., is sending out a bulletin descriptive of the Leahy No-Blind vibrating screen, used in handling rotary mud fluid.

"Why Customers Prefer Certain Service Stations" is among interesting articles in the current number of the Erie Meter Dial, published by the Erie Meter Systems, Erie, Pa.

The Bradford Motor Works, Bradford, Pa., and Tulsa, is sending out a set of its bulletins in a loose-leaf binder. The products covered B-M-W balls and seats, polish rods, liner barrels, working valves, valve cups, working-barrel valves, stuffing-boxes, seamless-steel working barrels and other oil field equipment.

Neilan Co., Ltd., manufacturer of automatic regulating and control equipment, is distributing a new and comprehensive instruction book describing in detail how to hook up and adjust all Neilan control devices. Copies of the book may be had by communicating with Neilan Co., Ltd., 641-651 Santa Fe Avenue, Los Angeles, Calif.

The Westinghouse general catalog, 1931-1932, with 1,352 pages presenting descriptions and illustrations of products manufactured and sold by the Westinghouse Electric & Manufacturing Co., includes data on practically every electrical product of interest to the petroleum industry, such as drilling and pumping motors and control, gearing, arc-welders, and supervisory control for multistation pipe lines.



PIPE LINES CONDITIONS

constant touch with field operations, and are acquainted with the most modern practices in every phase of pipe line welding. Active cooperation on thousands of miles of important pipe lines has given them an intimate understanding of field problems and their solution.

Linde Process Service brings to the pipe line industry these years of experience and the further help of valuable data developed through extensive laboratory research. It assures the most economical construction of dependable pipe lines.

THE LINDE AIR PRODUCTS COMPANY, THE PREST-O-LITE COMPANY, INC., OXWELD ACETYLENE COMPANY, UNION CARBIDE SALES COMPANY,
Units of UNION CARBIDE AND CARBON CORPORATION

General Offices . . . New York UCC Sales Offices . . . in the Principal Cities
65 Linde plants . . . 48 Prest-O-Lite plants . . 174 Oxygen Warehouse stocks . . . 156 Acetylene Warehouse stocks
42 Apparatus Warehouse stocks . . . 245 Union Carbide Warehouse stocks

Natural Gas Industry Developments

COLUMBIAN CARBON CO. INCREASES PRODUCTION

NEW YORK, Nov. 10.—Columbian Carbon Co. has substantially increased its production of gasoline and natural gas this year, but has a smaller production of pigments than last year, according to estimates of the 1930 operations just made by the company.

Natural gas output of Columbian for the full year 1930 is estimated at 49,000,000,000 feet, against 47,831,160,000 feet last year, while gasoline output for 1930 is figured at 45,000,000 gallons against 26,179,539 gallons produced during 1929.

Sales of natural gas by the company this year are estimated at 32,000,000,000 feet, compared with sales of 26,934,903,000 feet in 1929.

Natural gas sales by the company are expected to show a further substantial gain next year. The natural gas line now being constructed from the Panhandle in Texas to Chicago is partly owned by Columbian Carbon Co., and the company likewise holds a substantial interest in the Mississippi River Fuel Corp., which runs natural gas from the Louisiana fields to St. Louis. Columbian is also represented among the owners of the Interstate Natural Gas Co., controlled by Standard Oil Co. of New Jersey.

Carbon black output by Columbia Carbon Co. this year is not expected to exceed 100,000,000 pounds, against production of 104,855,183 pounds by the company last year. Production of other pigments, it is estimated, will approximate 15,000,000 pounds, contrasted with 17,487,437 pounds in 1929. Curtailment of rubber manufacture, it is explained, has reacted against both the consumption and the market price of carbon black.

BUTTE VOTES FOR FRANCHISE

CASPER, Wyo., Nov. 8.—The city of Butte has voted a franchise to the Montana Power Co. for furnishing gas to that point and the city of Anaconda has followed the lead of Butte and also granted a franchise to the company for the same purpose. Deer Lodge, Livingston and Bozeman are still to vote but are expected to vote for the franchises. The Montana Power Co. expects to lay a large trunk gas line that is to cost $15,000,000 and which will supply the cities and towns of the central part of the State with natural gas. The line is to be laid next season.

The Great Falls Gas Co. is installing equipment to odorize the gas in that city as a means of preventing explosions from leaks. The equipment adds the odorant at the rate of 2½ gallons to 1,000,000 feet of gas.

O. W. BOCKELOH DIES

O. W. Bockeloh, manager of the Great Falls Gas Co., died suddenly in a Shelby, Mont., hotel, following a heart attack. Mr. Bockeloh was also manager of the Great Northern Utilities Co., and the Southern Utilities Co. of Shelby. He was transferred the past summer from Michigan, succeeding A. H. Sikes as head of the various companies.

NEW MEXICO REORGANIZATION

The Southern Union Gas Co. of Delaware is reorganizing its New Mexico units. Its operating headquarters for New Mexico will be moved from Dallas, Tex., to two sub-headquarters, one at Albuquerque and one at Artesia, N. M., is to be head of the operations in Artesia, Carlsbad, Hagerman, Dexter and Lovington.

CANADIAN GAS NEWS

CHATHAM, Ontario, Nov. 8.—As a result of the recent decision of the Alberta Court of Appeal, a natural gas rate of 33 cents per 1,000 feet has been fixed for the town of Wainwright, Alberta. The town is supplied from wells of the Maple Leaf Gas & Oil Co. by the Wainwright Gas Co.

In connection with the scheme now being carried out for storage of waste gas from the Turner Valley Field in the Bow Island sands, Canadian Western's No. 13 well, 2 miles from Bow Island, is being repaired and reconditioned.

In connection with a vote to be taken by ratepayers of St. Thomas, Ontario, on a proposal to sell the municipal gas plant or in the alternative to renovate it at an estimated cost of $130,000 a special committee has been named by the city council to secure information for submission to the ratepayers before the vote on December 1.

ZEPPELIN TO USE HELIUM

Dr. Hugo Eckener announced at the annual dinner of the American Chamber of Commerce in Berlin that as a result of the recent disaster to the British dirigible R-101 he had changed his plans for Zeppelins now under construction so as to provide for helium gas and crude oil motors.

He said he had received word from America that helium gas, which is noninflammable and nonexplosive, would be available to inflate his airships in whatever quantities desired.

Doctor Eckener, who is world famous as commander of the Graf Zeppelin, said that had it not been for an explosion, the crash of the R-101 in France several weeks ago would have resulted in minimum damages. As it was, the great airship burned to almost nothing and 48 British lives were lost.

GAS HEATING IN WASHINGTON

WASHINGTON, D. C., Nov. 8.—A campaign for the introduction of gas in domestic heating plants in the District of Columbia has been launched. This has followed persistent authoritative reports that natural gas will be piped here in the near future. The company offering to install gas heating apparatus offers prospective customers a guarantee that gas will cost no more for this purpose than they have in the past expended for coal.—C. E. K.

MEMPHIS NATURAL DIVIDENDS

Directors of Memphis Natural Gas Co., 46 per cent of the common stock of which is owned by the Appalachian Gas Corp., have declared an extra dividend of 10 cents per share on the common stock and a regular quarterly dividend of 15 cents per share on the common, both payable December 31, 1930, to stockholders of record at the close of business December 15. The regular quarterly dividend of $1.75 per share on the preferred stock has also been declared, payable January 1 to stockholders of record at the close of business December 20.

MAY SELL T.P. GAS

Officials of the Texas Pacific Coal & Oil Co. in Fort Worth announced that sale of an interest in the company's natural gas properties in three states is under consideration. Texas Pacific Coal & Oil Co. has natural gas production in Central West Texas in Erath, Stephens and Palo Pinto Counties, in the Hobbs Pool of New Mexico and in Wyoming.

ONTARIO GAS PROJECT

CHATHAM, Ontario, Nov. 8.—Southern Ontario Gas Co., the Dominion Natural Gas Co. and associated companies have concluded an arrangement with the Steel Co. of Canada at Hamilton for a supply of coke oven gas to supplement the natural gas supply now furnished the Southern Ontario Gas Co.'s consumers in the eastern section of southwestern Ontario. S. B. Severson, general manager of the Dominion Natural Gas Co., states that his company will go ahead with its projected coking plant at Port Stanley, which will be required to supplement the natural gas supply in the western section of the territory served by the company. The Dominion company some time ago purchased for $30,000 a 50-acre site at Port Stanley, and a $3,000,000 plant is contemplated.

NATURAL GAS INTO ALBUQUERQUE SYSTEM

Natural gas has been turned into the major part of the new 390-mile pipe line system of the Albuquerque Natural Gas Co., a subsidiary of Southern Union Gas Co., according to an announcement made by T. F. Murchison, president of the company.

This fuel is now available to domestic and industrial consumers in Albuquerque, Santa Fe and Farmington, N. Mex., and Durango, Colo. Record time was made on the construction of this large project. The line was finished two weeks earlier than company officials originally planned and six weeks under the time limit set by the franchise.

Albuquerque Natural Gas Co. holds a long-term franchise in Albuquerque, Santa Fe and other towns in New Mexico. In Albuquerque natural gas will be distributed through the local line system of Federal Light & Traction Co. under franchise held by Southern Union Gas Co.

RULING ON HEAT UNITS

INDIANAPOLIS, Ind., Nov. 10.—The Indiana Public Service Commission has no authority to declare void a municipal franchise granted to a gas company and providing for a heating value of gas lower than that established by the commission, according to an opinion issued by the Attorney General, James M. Ogden.

In fact, says the opinion, a utility receiving a municipal franchise assesses by operation of law an indeterminate permit without the approval of the commission, subject only to the power of the commission to revoke the permit for cause.

The commission, it is held, even has no authority for the establishment of a uniform standard of heating value for gas furnished the people of the State, although the commission in 1920 adopted such a regulation, fixing 570 B.t.u. as the minimum heat unit of gas.

OKLAHOMA CITY FRANCHISE

A unanimous decision to grant a state franchise to J. G. Pundt, Texas utility operator, on his offer of 39-cent domestic gas, was reached by the Oklahoma City council. A contract with Pundt was signed by Mayor Walter Dean. A date for submitting the franchise question to the voters was not fixed.

MUSKOGEE REJECTS FRANCHISE

Muskogee, Okla., defeated the proposed 25-year franchise for the Oklahoma Natural Gas Corp. by a majority of 1,187 in a total vote of 6,091 in a special election.

CONTRACT SIGNED FOR MONTANA GAS EXPORT

CHATHAM, Ontario, Nov. 1.—Announcement is made that Range Oil & Gas Co. of Calgary has signed a contract to supply natural gas to the Montana Cities Gas Co. for distribution in Montana. The Montana Cities Gas Co. supplies gas to Great Falls and other urban centers, and the Canadian gas will supplement its Montana supply.

The Range Oil & Gas Co. several months ago secured from the Dominion government a special license to export natural gas from the Rogers-Imperial structure in southern Alberta, subject to certain conditions designed to safeguard Alberta consumers. Since then negotiations for sale of the gas have been in progress.

Some 14 miles of pipe line will be required to connect the existing system of the Montana Cities Gas Co. with the Rogers-Imperial well. Contract for construction of 7 miles of line from the well to the international boundary has been let to the Turner Valley Construction Co. At the boundary it will connect with an extension of the Montana Cities Gas Co. system. Six-inch pipe will be used. Much of the equipment is already at Coutts, and work is to be started at once. It is hoped to deliver gas to the Montana system early in December.

The Rogers-Imperial well is located 29 miles east of Coutts. It was started about 1923 by the Mark Rogers Syndicate of Lethbridge, later incorporated as the Canadian Oil & Refining Co., and the well was ultimately completed under joint arrangement by this company and Imperial Oil, Ltd. It came into large gas production at 2,528 feet in April, 1924, two sands being encountered. A few years ago the well and leases were taken over by the Range Oil & Gas Co. of Calgary, which started a second test on the structure and secured export privileges. The Rogers-Imperial well is stated to be the largest gasser ever drilled in the British Empire. Officials of the Range Oil & Gas Co. states that a recent test showed 41,000,000 feet a day with 600 pounds back pressure, and that the open flow production is around 60,000,000 to 65,000,000 feet a day.

Signing of the contract will lead to additional development in the Rogers-Imperial area. Recently a survey of the field was made by the Swedish-American Prospecting Co., whose operations indicate that the structure extends in a different direction from that shown on the early geological maps. Range's No. 1 was apparently drilled near the edge of the structure, and new drilling to be undertaken next spring will be spotted higher on structure. Range's No. 3 will be started in the spring.

Export of Turner Valley gas to Montana is not immediately contemplated, but the Rogers-Imperial supply may later be supplemented if necessary, from the Turner Valley gas.

MAY USE HELIUM IN HOMES

NEW YORK, Nov. 10.—Helium, the noninflammable gas used in dirigibles, may also be used in the future for heating and cooling purposes and to preserve food. Experiments indicating possibility of these uses have been reported to the American Chemical Society by W. E. Snyder and R. R. Bottoms. Because of its high conductivity of heat, helium may be used as a medium for circulation in heating and refrigeration systems. Helium used as a preservative of food keeps other gases, which encourage decay, from reaching the food, the experiments show.

Improvement in Production Practice

Summary of Some of the Outstanding Developments and Changes in Operating Trend. Conservation and Utilization

By W. W. Scott
Humble Oil & Refining Co.*

This paper has been prepared for the purpose of presenting a brief summary of some of the outstanding developments and changes in the trend of producing oil. The general attitude of the men in the oil industry toward the utilization of natural gas in the production of oil accounts for many important changes in the production business. Practical and technical men, as well as executives, have become well informed on the proper handling of wells and structures to take advantage of reservoir energy in order to produce oil and gas at an economical and efficient rate.

Perhaps one of the most interesting advances is the project of the Humble Oil & Refining Co. in the field near Olney in Young County, Texas, where a small pool has been set aside for the purpose of experimenting with repressuring with natural gas and the maintenance of pressure while being produced. The purpose is to determine if the oil reservoir will be benefited by conserving the gas and returning all or a large fraction of it to the pay sand. This field has a productive area of about 80 acres; is about 1,000 feet in depth, and has an average sand thickness of about 19 feet. The pool had almost reached its economic limit, since the production average was about 2 bbls. per day per well before the gas injection was started. Gas injection was started in January, 1930, and by October 1 almost 100,000,000 feet of gas had been injected into the pay sand, and the oil reservoir pressure lacked only a few pounds of reaching 400. It is planned to stop the gas injection when the average reservoir pressure is between 400 and 450 pounds per square inch, and then let the reservoir stand quiet for a while to study the equalization of pressure. About December 1 oil production will be started, and oil produced at the most efficient rate. Gas produced with the oil will be collected, compressed, and returned to the reservoir. The primary objects of this project are:

1. To measure the amount of additional oil that can be expected where the gas is returned to the pay zone during the early life of the field.
2. To measure the effect of the retarding of the pressure decline on extending the flowing life of a field.

Objects of Experiment

Besides the above objects, the experiments will provide an opportunity to obtain data on:

1. Gas migration through the sand; pressure gradient when the gas is moving through sand; pressure gradient when there is no movement, and the rate at which gas goes into solution in the oil sand reservoir.
2. Variation of bottom hole pressure with rate of the production and the effect of the production rate of the pressure differential between the reservoir and the well.
3. The flow of oil and gas mixtures in vertical pipes which may aid in the design of flow tubing.
4. Drainage of the wells and extent of interference.

The Sugarland oil field located in the Texas Gulf Coast area about 25 miles southwest of Houston holds a unique position in present-day oil fields. This field is an example of the important role played by natural gas in the production of oil. In this field it has been possible to produce the oil in such a way as to allow the average pressure on the reservoir to fall off as slowly as possible with a given amount of production. This has been accomplished by keeping the average gas-oil ratios of the field as low as possible, by flowing the wells efficiently, and by closing in wells unfavorably located on the structure that could not be produced except with high gas-oil ratios. All of the gas produced with the oil is collected, and about 85 per cent or more has been compressed and returned to the reservoir. The injection pressure is approximately 1,400 pounds.

Benefits Outlined

The original rock pressure was between 1,450 and 1,500 pounds, and up to the present time the formation pressure has declined not in excess of 200 pounds. The benefits from the return of gas to the sand are:

1. With the low net gas-oil ratio possible with the return of gas to the pay zone, the reservoir pressure declines slowly; and after given oil withdrawals, the reservoir pressure will be much higher than it would be without gas return Therefore, it can be assumed that by slow pressure decline, the actual ultimate production will be increased materially.
2. With the slower reservoir pressure decline, the bottom hole pressure will at all times be greater and the flowing life of the field extended probably throughout the entire production life. The pumping cost of a large volume of oil will be saved.

In any oil pool that depends upon gas movement for production, and one in which it is possible for a single operator or a group of operators to develop the pool as a unit, the cost of conserving gas and returning it to the reservoir will be amply repaid by reduction of lifting cost and increased production from the pool.

Tubing Wells

The subject of tubing wells for gas conservation has been one for discussion regarding the merits of the program. This subject is discussed briefly later on in this paper; but it is interesting to note that in the Yates oil field information from 55 representative wells, which were tubed after being completed and produced through casing, had a gas saving of 33 per cent by volume. On the other hand, in the Sugarland oil field, where the field is produced at a very low gas-oil ratio, at least 10 per cent in volume of gas has been saved by the use of tubing as a flow string.

The industry during the past few years has also generally recognized the benefits to be derived from the control of flowing wells. Since gas supplies the energy by which oil is brought to the well and surface, its conservation and efficient use are highly important if the maximum recovery is to be obtained from a given reservoir.

It is generally accepted that the basis of measuring efficiency of production of oil is by its gas-oil ratio. The gas-oil ratio of the wells can be controlled by means of back pressure, size and depth of tubing. In most fields the control of gas-oil ratio is accomplished at the surface by means of back pressure, and in others by means of choking or holding back pressure on a gas and oil separator Specific information on this subject is given in this report.

The determination of the allowable production to be produced from a given well in a field which is prorated has been one of the major problems before the producers. It is, therefore, the duty of the production engineer to give the industry a definite, accurate, and positive method of determining the allowable production to be taken from a well without making an open flow test.

Potential Production

In the past each operator has been allowed a certain production which is proportional to the potential production of wells on his holdings. The potential production of wells has been determined by an open flow test, which consists in measuring the production of a given well under open flow for a period of time which is frequently as short as one hour. An open flow test of this kind has disadvantages. In some cases there is a possibility of damaging the mechanical conditions of the well and accelerating water encroachment. Most important of all, the open flow test does not give an accurate gauge of a well, since the open flow production of a well for a short period is dependent upon the skill of the workmen to manipulate the open flow test after the well has been standing for a considerable length of time. It is possible to obtain a production for a few hours' period which does not represent the productive capacity of the well over a long period of time. The method proposed is briefly summarized as follows:

The capacity of a given well is dependent to a great extent on the energy losses in the producing sand. These energy losses can be evaluated by determining the relationship between the bottom hole pressure and production. The small well will show large drops in bottom hole pressure as the production rate increases, while the larger wells may produce at high rates of flow with very little change in bottom hole pressure. In as much as this relationship exists, and since the capacity of a well is largely dependent upon it, an equitable system of proration could be developed which would make use of the decline of bottom hole pressure with production rate as a gauge of a well's capacity.

In order to prevent undue drainage of oil on one property through wells on another property, the pressure drops from the property line to the base of the various offset wells should be nearly the same in all cases. If this is done, the danger of an unequitable distribution of oil would be minimized. Although the labor involved in obtaining the data for such a method is probably greater than that required to make the open flow test, it is believed that such a system will give a more just distribution of the oil, and will involve less danger to the wells themselves, than will the system in which the open flow test is used.

During the past few years it has become general practice in certain areas to adapt gas-lift to wells of small size. The use of continuous gas-lift reaches an economic limit in small wells beyond which it is not advantageous to go, by reason of excessive consumption of gas and oil produced. This economic limit is reached early in the life of wells, as the depth increases. It has been found that under certain conditions the continuous flow can be replaced by intermittent flow and lifting cost can be held at a low figure. The use of intermittent flow, as well as any other production method, must be applied where conditions are favorable.

EFFECT OF EARLY GAS INJECTION

By H. D. Wilde, Jr.
Humble Oil & Refining Co.

Theoretical considerations will show that if an oil pool depends essentially on gas energy to move the oil to the well, the pool will be benfited by conserving the gas and returning all or a large fraction of it to the reservoir. However, so far it has been impossible to estimate how great an increase in the ultimate recovery will result or how long the flowing life can be extended by this procedure. Even if this procedure is used in an actual field, it is impossible to evaluate the benefits derived, as there is no way of knowing what the field would do if it were produced in the usual manner unless special and extensive experimental work on the field is conducted. Any suggestions for extensive experiments designed to yield information on this question on an important producing field would be opposed because of probable interference with regular operating schedules and commitments, because of the great expense involved in such large scale experimental work, and because of the possibility of injuring the field.

The ideal way to get the information would be to find two unproduced fields, small enough to be unimportant sources of oil, both wholly controlled by the same company, and both near enough alike in their characteristics to make the results comparable. One field would be produced in the usual manner, while the other would be produced under such conditions that the gas produced with the oil could be returned to the reservoir. The chances that the company desiring to do the experimental work would be able to find such an ideal set-up at the time it was ready to carry on the work are almost negligible.

Failing this, the next best way would be to take a small pool where water encroachment is absent and one that is entirely under the control of the company. The pool would be produced in the usual manner until the reservoir pressure fell to atmospheric and the production rate had reached the economic limit. Then all producing wells would be shut in, and the pressure on the reservoir built back up to the original value by injecting gas. If this were done, the original reservoir conditions would be reproduced, with the exception that the per cent saturation of the sand with oil would be less and not all the oil in the sand would be saturated with gas. The repressured pool would then be produced under such conditions that all gas accompanying the oil would be conserved and returned to the reservoir. All oil so produced would be additional oil that would be obtained from the pool had gas return been practiced from the start. The additional oil obtained could be compared in volume with that obtained under normal operation, and the increase could be expressed in per cent. This would also show how effective gas return would be in extending the flowing life of the field, and whether flowing is solely a function of the reservoir pressure or whether it also depends upon the extent of depletion of the reservoir.

Description of Experimental Pool

The Humble Oil & Refining Co. was anxious to carry on a repressuring experiment of this nature, and looked around for a suitable pool. A small pool in North Texas, a few miles north of Olney in Young County, seemed well suited for this work. It is located beneath two leases, has a productive area of about 80 acres, is about 1,000 feet below the surface, and has an average sand thickness of 19 feet. The structure is slightly arched, and there is practically no edge or bottom water, as the reservoir is completely sealed off above, below and around the edges with impervious strata. Evidence indicates that there is good communication from one part of the pool to another. There are 21 producing wells spaced 300 feet apart. These wells did flow for a few weeks, but produced most of their oil on the pump. The pool had almost reached its economic limit as the production, just before repressuring was started, averaged only 2 or 3 bbls. per day per well. The reservoir pressure had been reduced to below atmospheric, as the

*Presented at eleventh annual meeting, American Petroleum Institute, at Chicago, Ill., November 12, 1930.

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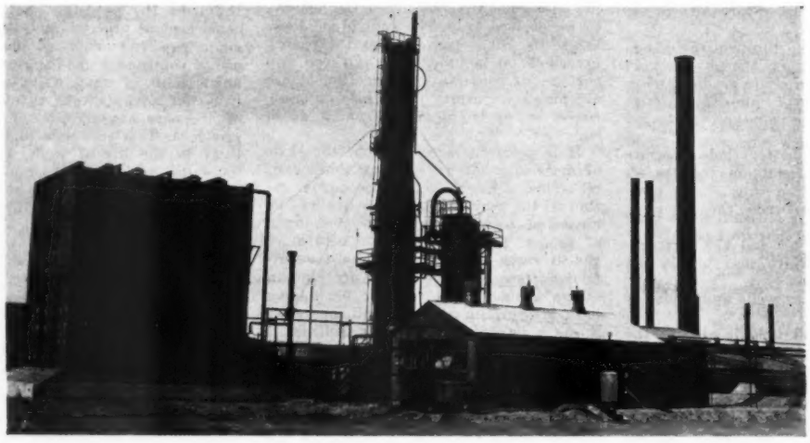

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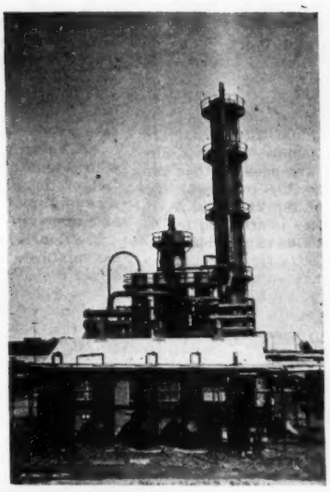

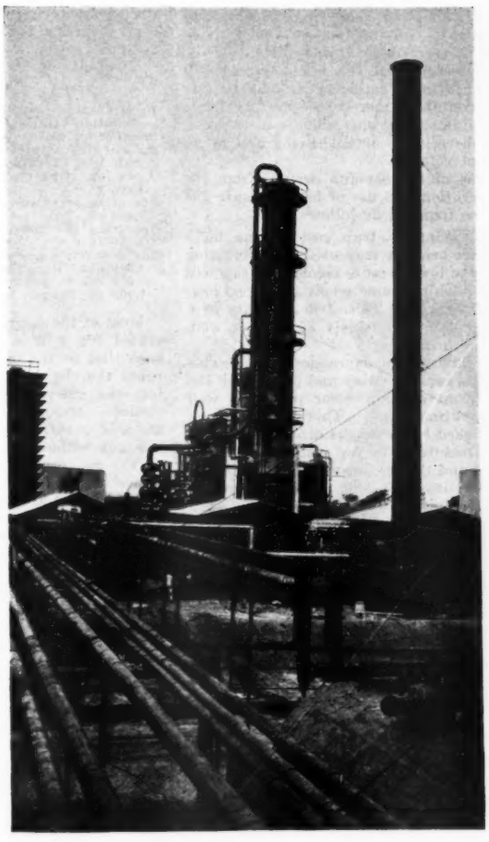

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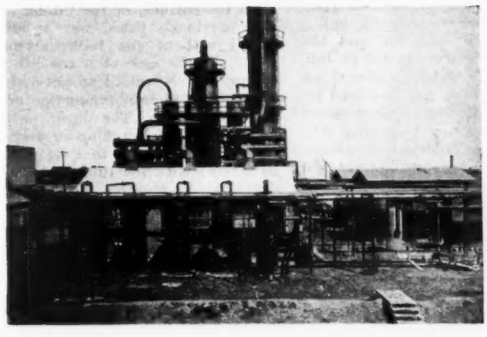

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casingheads of the wells had been tied in to a natural gasoline plant.

One of the two leases overlying the pool was held by the Humble company; the other was acquired in order that the pool could be treated as a unit in this experimental work. Gas needed for pressure restoration was available at 150 pounds from a commercial gas line passing over one of the leases.

Experimental Work

When the experimental work was started, all wells were shut in and cleaned. All wells are now equipped with 2-inch tubing suspended in the hole to within a few feet of the bottom, but are not supplied with pumps. The gas distributing system is arranged so that gas can be injected into the tubing or the casinghead of any of the 21 wells. A recording pressure gauge is attached to the tubing head of each. Gas can be bled into the tubing at slow rates through a quarter-inch line and needle valve to keep fluid from entering the tubing, and in this manner the recording gauges give a continuous record of the bottom hole pressures of all wells. All wells have orifice meter plates in the gas lines to them, so that the amount of gas injected in each well can be measured. The orifice flange and meter are on the gas injection line. To the right of the well are the stopcocks for admitting gas to the casing or the tubing and the quarter-inch valve for bleeding in gas for pressure measurements. The stopcocks on the left of the well are connected to the lead lines to the gas separators, when the well is put on production.

Each lease is equipped with two sets of gas separators, meters, and stock tanks; and the producing wells will be so manifolded that the production from any one well can be handled in one set, while the production from the rest will be handled by the other. In this way the daily production of oil and gas from individual wells can be successively measured. A three-stage compression plant is so arranged that it can take gas from the separators or gas purchased from the commercial gas line and compress it to pressures needed for injection into the reservoir. The discharge pressure may be as high as 800 pounds if necessary.

The original rock pressure, and consequently the value to which the pressure must be built to restore original conditions, is not known exactly, but it is believed to be between 350 and 450 pounds. Gas injection was started in January of this year, and by October 1 almost 100,000,000 feet of gas had been injected, and the average reservoir pressure lacked only a few pounds of reaching 400. Ten of the wells, on alternate locations, had been set aside for use as injection wells as needed. The remaining 11 will be used as production wells.

It is planned to stop the gas injection when the average reservoir pressure is between 400 and 450 pounds, and then let the reservoir stand quiet for a while to study the equalization of pressure. About December 1 oil production will be started. Wells will be able to flow with ratios as low as 300 feet per barrel, if the bottom hole pressure is 150 pounds or more. On account of proration restrictions, it will not be possible to produce the field at its full capacity; and, hence, chokes will have to be used. However, flowing at full capacity would be undesirable, so this is not an objectionable restriction. The choke size on each well will be varied to study the flowing characteristics of the well. Thereafter, the wells will, as far as possible, be produced at the most efficient rates. The gas produced with the oil will be collected, compressed, and returned to the reservoir. Because the oil in the reservoir will not be completely saturated, the return of this gas will not retard the decline of pressure as much as gas return in a new pool and, consequently, enough outside gas will be injected into the reservoir to make the pressure decline equal to that in a new pool.

As mentioned above, the primary objects of this experimental work are to measure the amount of additional oil that can be expected from gas return started when the field is still young, and to measure the effect of the retardation of pressure decline on extending the flowing life of the field.

In addition to these, the experiment provides an excellent opportunity of gathering data on other points. Already it has furnished considerable data on gas migration through sand, pressure gradients when gas is moving through sand, pressure gradients when there is no movement (bubble resistance), and the rate at which gas goes into solution in oil in a sand reservoir.

It is hoped that as the experimental work continues, it will be possible to get data on:

1. Variation of bottom hole pressure with rate of production and, hence, the effect of the production rate on the pressure differentials between the reservoir and the well.
2. General data on the flow of oil and gas mixtures in vertical pipes which may aid in the design of flow tubing.
3. General data on drainage areas of wells and the extent of interference.

If the objects listed above can be attained, the experimental work will be well worth the expense and effort involved.

TUBING WELLS UNDER PRESSURE

By H. A. Brett
Union Oil Co. of California

To obtain the maximum production efficiency from a well, it is usually necessary to change the tubing conditions several times during the life of the well. Heretofore, to make these changes, it has been necessary to kill the well, an expensive and oftentimes hazardous operation, considering the loss of production, as the result of down-time required to perform the operation, and the possibility of the well blowing in out of control.

Another feature of well control which has caused considerable difficulty is the starting or kicking-over of deep gas lift wells in which the depth of the tubing is 5,000 feet or over. Kick-over pressures for wells thus tubed are so great as to be impractical, both from the standpoint of safety and the special equipment required such as compressors, pipe fittings, etc.

To overcome the difficulties mentioned above, a device has been perfected whereby a naturally flowing well may be tubed from the surface, or the tubing in such a well previously tubed may be lowered or raised without any interruptions of its flow. In the case of a gas lift well, its tubing may be raised or lowered without any interruption of production or flow of circulating gas. The device is of great value in lowering tubing in deep gas lift wells, for the reason that circulation may be started with the tubing at a moderate depth which requires only normal pressure, and then lowered to any desired depth. As circulation is continuous, the fluid column is aerated at all times, and hence no excessive pressures are required.

Control of Flowing Wells

As gas is the chief expulsive force by which oil is brought to the well bore and to the surface, its conservation and efficient use are highly important if the maximum recovery is to be obtained from the reservoir. It follows, therefore, that the amount of gas produced per barrel (the gas-oil ratio) is an indication of production efficiency, the lowest gas-oil ratio possible, of course, being the most desirable. A comparison of gas-oil ratios is possible only between similar wells in a given reservoir.

Gas-oil ratios are subject to control by means of back pressure, size and depth of tubing. As tubing changes are made with difficulty once the well is on production, the control of the gas-oil ratio is accomplished at the surface by means of back pressure, either by choking or trap pressure. The latter is the more desirable, as the gas energy is then available for such uses as gas lift, repressuring, sales, etc. The optimum back pressure varies with each well, and is different in a given well at different periods during its life.

Each well should be so equipped that changes in back pressure are readily made, and results observed in order that a measure of production efficiency may be obtained.

In order that the required changes in the flowing conditions may be made in an intelligent manner, a complete daily record of performance must be available. This record consists of an accurate measurement of both gas and oil and also the pressure on the casing, tubing and gas traps. Recording pressure gauges are much to be preferred to dial gauges.

One of the greatest economies which can be practiced in the operation of an oil field is the conservation and use of the energy contained in the gas from high-pressure naturally flowing wells.

Naturally flowing wells must be operated against certain back pressure if they are to be produced in an efficient manner. This back pressure is controlled at the surface by beans or by pressure regulators. If chokes are used and the gas expanded to a pressure just sufficient to operate an absorption plant, or blown to the air, the contained energy is dissipated without performing any useful work. If, on the other hand, the gas is expanded in a high-pressure gathering system, the energy contained therein becomes available for use in several operations, and the company benefits in actual saving and in increased volume.

Some of the benefits derived from the conservation and use of high-pressure gas may be itemized as follows:

1. Saving in trap costs. One high-pressure primary trap used in conjunction with one low-pressure secondary trap will accomplish the same result as several low-pressure traps. This item amounts to a saving of approximately $4,000 per well, in some instances.

2. Saving in compression costs. This includes capital outlay and interest on the investment of compressor plants as well as operating costs. This saving is accomplished by using gas directly from the high-pressure gathering system for repressuring and the operation of gas lift wells. In many instances, the pressures required for these operations will be greater than that available, and recompression will have to be resorted to, but at a cost far below that required to raise the pressure from atmospheric, or even 30 pounds.

3. Sales to industrial and domestic gas companies. Wet gas under high pressure is readily disposed of to gas companies, which otherwise would have been blown to the air, as the cost of installing compressors to raise the pressure to that required by the gas company would, in most cases, be prohibitive. This item represents an actual cash return of many thousands of dollars per year.

4. It is often possible to sell excess high-pressure gas to other operators for treatment in their absorption plant.

5 Saving in pipe line costs due the increased capacity of lines transporting high-pressure gas.

California Example

As an example of what has been accomplished by one company at Santa Fe Springs, California, during the last two years, as the result of utilizing high-pressure separation, the following figures are quoted:

Item 1.	Saving in gas trap expense	$150,000
Item 2.	Saving in compression costs on high-pressure gas actually utilized	480,000
Item 3.	Saving on all gas sold (otherwise blown to air)	206,000
Item 4.	Profit on gasoline royalty recovered from treating high-pressure gas (other companies)	26,000
Item 5.	Savings due to decreased pipe line costs	40,000
Total		$902,000

From the above, it is quite evident that the utilization of high gas-oil separation pressures at the well is a very profitable procedure and one of the outstanding advances made by oil companies during the past few years.

A recent development in pumping equipment is a gas-operated jack that has much merit; and although used to limited extent, it is worthy of mention due to the fact that gas energy is utilized for its operation. This equipment may become an important factor in the rod pumping of deep wells.

The use of large areas and the counterbalancing action of compressed gas in the large tank makes possible its use on deep wells without excessive pressures (125 pounds to 150 pounds for 5,000-foot lift).

Oil is used between the inside ram and the counterbalance pressure tank. An ingenious arrangement of throttling valves in the gas and counterbalance oil lines makes possible almost any type of pumping motion desired. At present these jacks are made in two sizes, 6 and 10-foot strokes. The stroke length may be varied in any individual installation from 1 foot to maximum by changing the [illegible] tion of the rods. The speed may be varied from 1 to 10 strokes per minute by the throttling valves. Changes of spe[illegible], stroke length and motion may all be varied in a few minutes.

The first cost is not excessive, and the installation cost low. A jack can be installed in a rig with a cellar in about four hours. The following tabulation gives a few of the pertinent figures on this equipment:

Jack, 6-foot stroke	$2,700
Jack, 10-foot stroke	3,000
Installation cost, rig with cellar	100
Installation cost, rig without cellar	300
Stroke, 1 foot to 6 feet or 10 feet.	
Speed, 1 to 10 strokes per minute.	
Operating pressure—2-in. pump, 15 lbs. per 1,000 ft.	
Operating pressure—2½-in. pump, 20 lbs. per 1,000 ft.	
Operating pressure—3-in. pump, 25 lbs. per 1,000 ft.	
Gas consumption—	
1,000 cu. ft. per bbl. lifted at 2,500 ft.	
2,000 cu. ft. per bbl. lifted at 4,500 ft.	
3,000 cu. ft. per bbl. lifted at 5,500 ft.	

Most of the deep fields of today are operated for a time on the gas lift. At such time as the decline of the well warrants the change from gas lift to pumping, the gas-operated jack could be installed. Many wells produce sufficient gas under sufficient pressure to operate the jack without outside power. As soon as the gas production falls to the point where outside pressure must be used, the gas lines and facilities used for gas lift may be used for operating the jacks. Inasmuch as this equipment is already installed, it cannot be considered as an investment charged to the jack. Under such conditions, it seems highly probable that the gas-operated jack may have an important place in the economic development of the deeper fields.

Power to operate this jack may also be obtained by double trapping flowing wells from which high-pressure (150 pounds) gas may be obtained; thus utilizing gas energy as supplied by producing wells.

DETERMINATION OF POTENTIAL WITHOUT OPEN FLOW TEST

By T. V. Moore
Humble Oil & Refining Co.

Water encroachment and the wanton dissipation of gas energy can, in most instances, be effectively checked by the use of efficient production methods and by removing oil from a natural reservoir at comparatively slow rates. Hence, if the waste of an invaluable and irreplaceable natural resource is to be kept at a minimum, a sound operating policy will demand restricted production, even though the economic factors which have forced curtailment upon the industry should cease to exist.

In the restriction of the production of a given field to a reasonable value, the problem of an equitable system of proration at once arises. It has been considered good practice to allow each operator a certain production, which is, to a large extent, proportional to the potential production of his holdings. The potential production of wells in such fields is usually determined by an open flow test, which consists in measuring the production of a given well under open flow, for a period of time which is frequently as short as one hour. Even this short period of unrestricted production has in many cases led to serious water encroachment, which may result in permanent injury to many wells. Furthermore, the open flow test does not give an accurate gauge of a well's capacity. The

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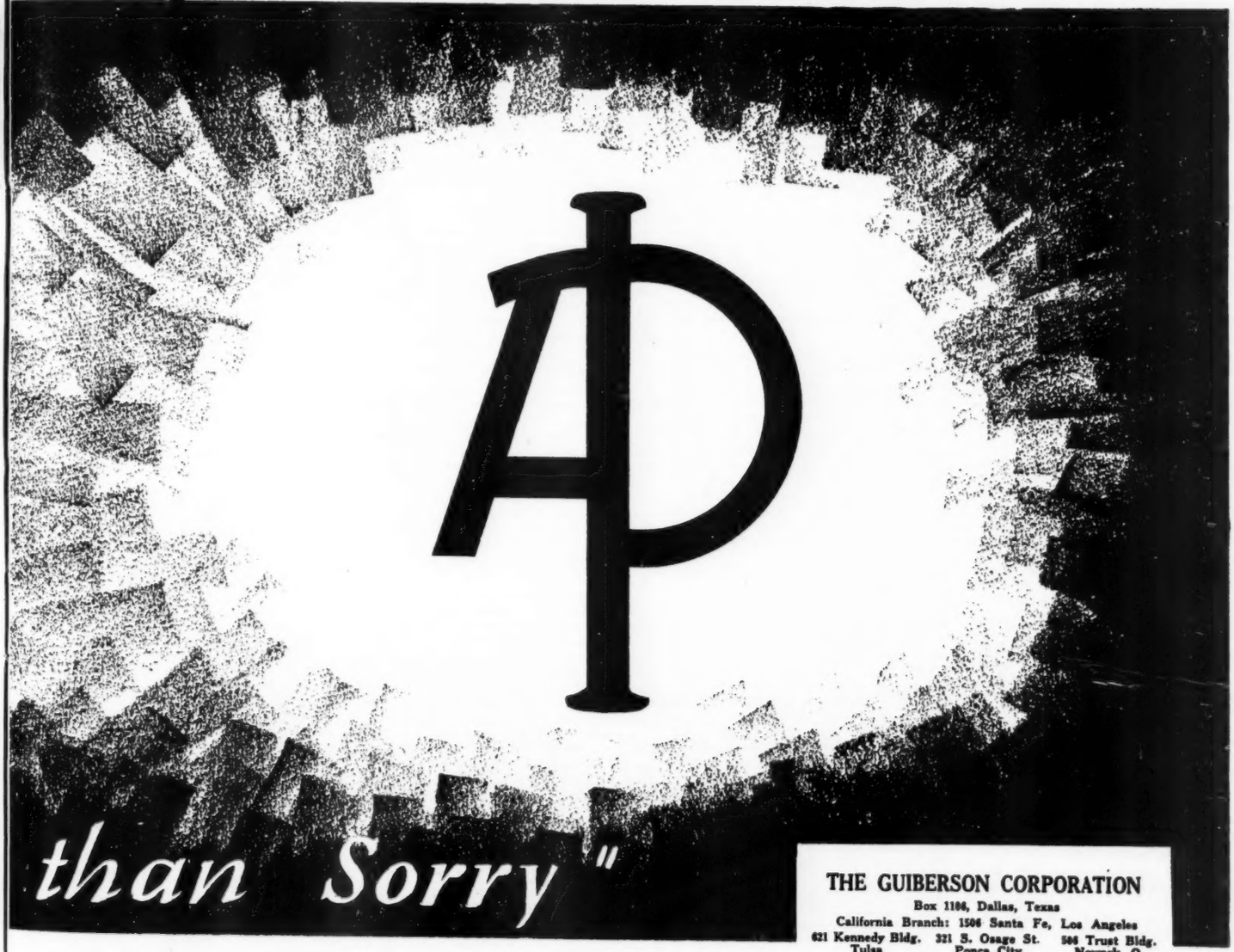
you will always find the other



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Control of Color by Acid Treating

Laboratory Procedure Developed Capable of Operating Under Variety of Combinations. Interesting Data

By H. M. Weir, W. F. Houghton and F. M. Majewski
The Atlantic Refining Co., Philadelphia*

During 1929 sulphuric acid worth more than $8,300,000 was applied to some 34,000,000 bbls. of lubricating oil in the United States. The value of the acid irrevocably lost in the treatment was in excess of $3,000,000, and the volume of lubricating distillate degraded to the value of fuel oil was probably not less than 3,000,000 bbls.

Though such figures promise financial savings which should amply repay fundamental study of the action of sulphuric acid on oils, it is a fact that very little literature has appeared which offers any basis for understanding what better acid treating is and how it may be accomplished.

No doubt the extreme complexity of heavy oil mixtures is responsible in large part for this situation, but tacit agreement on the part of many prospective workers with the old "axiom" that practical treating results cannot be obtained in laboratory apparatus has greatly hampered serious research work in the field. This paper presents a method of acid treating oils in the laboratory and of analyzing the results so that the conclusions can be directly applied to plant procedures without any factors other than the inefficiency of the latter.

First Logical Step

It need hardly be mentioned that the first logical step in the improvement of a procedure is to measure its efficiency in terms of factors which bear a mathematical relationship to the effects produced. Finished lubricating oils are held to rigid specifications for gravity, viscosity, color, color stability, pourpoint, bloom, steam emulsion number, and acidity. The first three factors are capable of accurate measurement; the others are, in the present state of the art, highly artificial stipulations rather than determinations. Of the three factors which thus might offer a basis for study, the only one which seemed at the beginning of this work to stand in the relationship of cause and effect with respect to acid treating was the color of the oil.

On this basis alone, color was selected as the primary variable in studying acid-treating phenomena. Though it was felt highly desirable to retain as much standard practice as possible, the use of any standard color scale and colorimetric method was immediately ruled out. It seemed very unwise to attempt to clarify the relationships in an admittedly complicated series of reactions while hampered by units of measurements which, of themselves, bear no simple relationship one to the other.

Colorimetric Scale

The method of measuring and expressing the colors of oils which was selected is an adaptation of the system of measuring oil colors first published by Parsons and Wilson. This system was first used by one of the authors in 1924 in unpublished work on the value of absorbents in "decolorizing" oils, work which paralleled to some extent the later work of Rodgers, Grimm and Lemmon. The interested reader may refer to these papers to obtain detailed information on this method of relating colors of oil. Discussion is purposely avoided here, since a paper will shortly appear from the laboratories of this company extending the accuracy of the method and pointing out certain conditions which must be met for most accurate results. It suffices to state that the system is based on a definition of color entirely similar to the concept of concentration of solutions.

*Presented at eleventh annual meeting, American Petroleum Institute, at Chicago, Ill., November 13, 1930.

LABORATORY PROCEDURE

In order to control acid treating in the plant, a laboratory acid-treating procedure has been developed which is capable of operating under a variety of combinations. The method enables one quickly to determine for any oil the quantity and concentration of acid and the best conditions necessary for optimum color and oil yield. The samples employed are small, although large enough to allow further study on such details as bloom, color stability, gravity, viscosity, filter yield, etc. The results are reproducible and directly related to plant practice.

A complete study of the treatment of solar reduced stock, with acids of concentrations varying from 75 per cent to 98 per cent, was made which revealed interesting data on color removal, gravity, viscosity, index of refraction, oil loss, acid loss, and the heat of acid-treating reactions. On the basis of the results of this investigation, some discussion of the generally accepted theories of acid treating is introduced.

Thus a suitable oil is arbitrarily assigned a standard color figure, say 10. By definition the color which results by mixing S volume parts of the standard oil with W volume parts of a white oil is taken as

$$\frac{S}{S+W} \cdot 10.$$

The colorimetric scale and method are so arranged that this concept of color concentration is retained over the whole range of colors—from the darkest distillate to a white oil itself.

This color scale meets two requirements which are deemed absolutely fundamental: (1) A simple mathematical relationship between readings, as mentioned before; (2) the system makes it possible to assign color to the darkest distillate—a "black" oil in common parlance—in terms of the same units of color as those used to express the color of highly refined products.

The adoption of a simple and straightforward definition is, of course, no guarantee of simple physical relationships; but the character of the results which will be presented apparently justifies our original assumption that such would be the case. At all events, the ability to measure the color of very dark (dirty) oils gives a criterion of the quality of the raw material which apparently has not previously been used in studying acid treatment, despite the fact that it would appear to be fundamental to any serious study.

Colors taken on this scale were termed "true colors," abbreviated "t.c."; and a method of acid treatment was devised which uses the smallest possible amount of sample consistent with complete inspection of the product. A description of the treating procedure follows, together with typical results. Certain conclusions on the mechanism of acid treating are given, and some speculations which we hope to explode or confirm in the future are also cited.

Standard Treating Procedure

Before studying an untreated or reduced lubricating oil, its original color (true color), viscosity and gravity are determined. The acid employed is measured from a 1 cc. or larger pipette directly into a graduated 100 cc. basic sediment centrifuge tube containing 100 cc. of the oil to be treated. The acid falls through the oil and collects at the bottom as a light brown liquid, increased in volume approximately 10 per cent. The acid treatment is always carried out in duplicate.

After the addition of the acid, the tubes are closed with rubber stoppers and placed in groups of four in a mechanical shaking machine. The time of treating is measured from the start of shaking. In the shaker the tubes move about 3 inches backward and forward, 235 times per minute. When treatments at temperatures other than room temperature are made, the shaker is placed in a cabinet, the temperature of which can be controlled within 2° F. over the range of 80-170° F., and the oil is brought to the treating temperature before the acid is added.

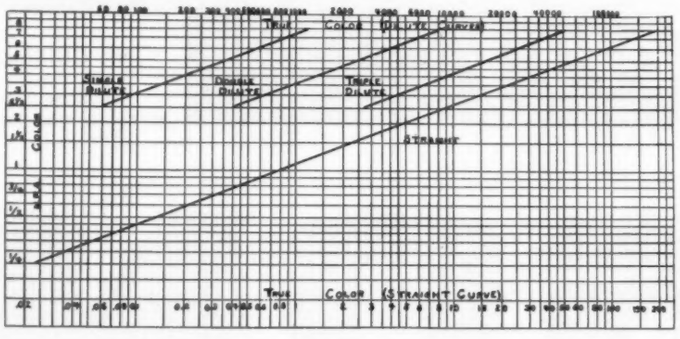


Figure 1—Conversion chart.

N.P.A. Color:
Upper Scale—Dilute N.P.A. Colors.
Lower Scale—Straight N.P.A. Colors.
Dilutions made with White Oil.
Single Dilute=15% Oil—85% Diluent (by vol.).
Double Dilute=2.25% Oil—97.75% Diluent (by vol.).
Triple Dilute=0.34% Oil—99.66% Diluent (by vol.).

True Color:
True Color Standard is a filtered Manchester Spindle Oil (Color 2½ + N.P.A.)
Oil Standard=10 True Color.
53.6 m.m. Oil Standard=Robinson.
Color Glass (Pale).
Straight N.P.A. Color=1.06 $C^{0.594}$.

The samples are shaken in the mechanical shaker until equilibrium is attained. The time for this varies, and must be ascertained for each type of oil. It is determined as follows: 0.5 cc. of acid is added to each of two tubes containing 100 cc. of the given oil, and 1.5 cc. each to two additional tubes containing 100 cc. of the same oil. The volumes 0.5 cc. and 1.5 cc. are, respectively, those quantities of acid which usually will undertreat and slightly overtreat the oil. For other oils, the quantities may be larger or smaller. The tubes are shaken for 10 minutes, centrifuged at 1,500 r.p.m. for one hour, and then examined for true color. In the same manner, the color is obtained on similar sets of tubes shaken for 25, 40 and 60 minutes, thus providing four points from which a color-shaking time curve for 0.5 cc. and 1.5 cc. of acid can be drawn. That shaking time which reasonably assures that the treatment has reached equilibrium or is at the optimum color is taken as the shaking time for all further tests. For viscous oils this may be from 20 to 40 minutes; while for naphtha-fluxed oils the optimum shaking time is usually 10 minutes.

Rather than wait for the sludge to settle out, the tube is centrifuged for 60 minutes at 1,500 r.p.m. It was found that centrifuging for at least 40 minutes was required to remove all of the fine pepper. Centrifuging at elevated temperatures was accomplished by passing burner gases at controlled temperatures around the jacketing framework of the centrifuge.

The oil colors were measured by means of the Duboscq colorimeter. The oil sample was diluted with a 50-50 mixture of white oil and extraction naphtha to a color of approximately 2½ N.P.A., and then compared with a 20 mm. depth of the standard oil (Manchester spindle). The average of six readings, read to within 0.1 mm., was taken as the final reading and the true color calculated by the following formula:

$$\text{True color} = \frac{20 \text{ mm.} \times \text{dilution}}{\text{average of 6 readings of unknown oil}} \times \text{true color of standard}$$

in which

$$\text{dilution} = \frac{\text{cc. of mixture}}{\text{cc of unknown oil}}$$

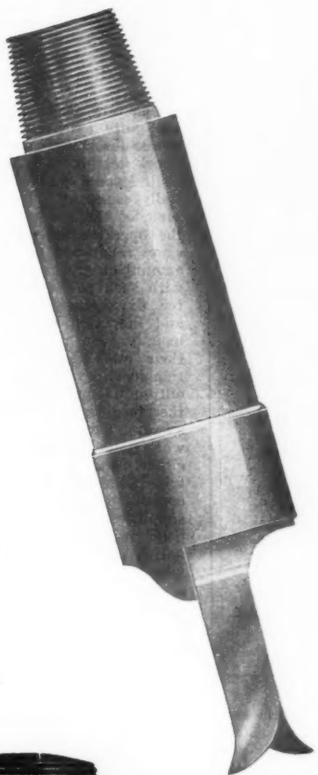
Three Types of Color

Three types of colors were usually taken, the "sour oil" color, the "ammonia" color, and the "caustic neutralized and washed" color. The "sour oil" color was taken by the straight dilution of the sour oil; the "ammonia" color was taken after the oil had been saturated with anhydrous ammonia until no further change in color resulted; and the "caustic neutralized and washed" color was taken after neutralizing, washing and brightening the sour oil at 150° F. Colors of duplicate samples usually checked within one true color unit.

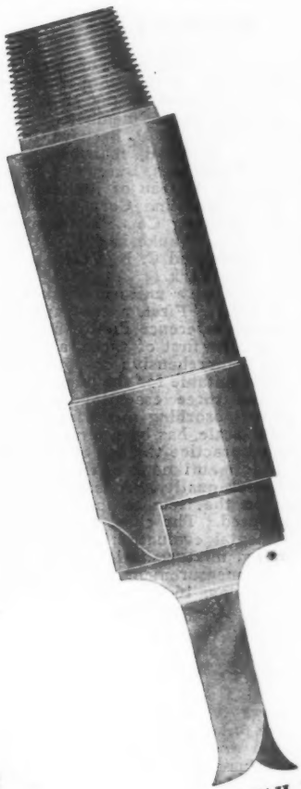
A few additional facts concerning the true color scale should be mentioned. This scale is based upon a standard color oil, which in our case is filtered Manchester spindle oil of 2.6 N.P.A. color, and finally upon a No. 2 Robinson glass. The standard oil is calibrated in terms of the glass so much that when 53.6 mm. of the standard oil matches the Robinson glass the standard oil is said to have a true color of 10. The standard oil is rechecked every week; and, if it has be-

(Continued on Page 173)

A new Safety Drill Collar



FISH TAIL BIT
Locked



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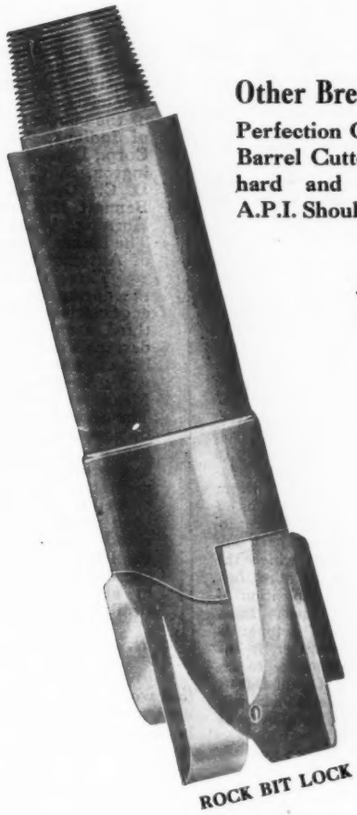

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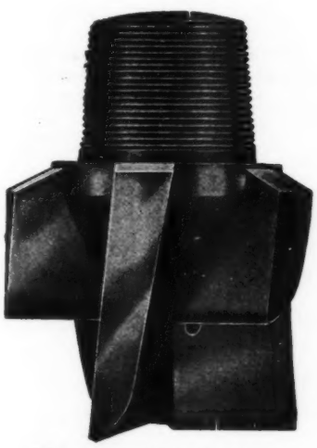

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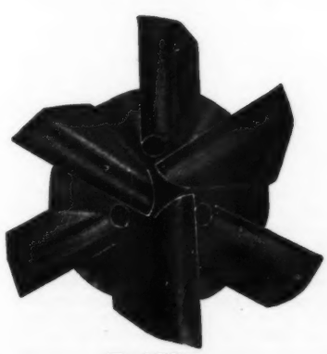

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Uniformity in Measuring Detonation

Three Things Essential to Method of Measuring Antiknock Qualities of Fuels. Standardized Engine Designed

By T. A. Boyd*

ABSTRACT

This paper gives an account of the work of the subcommittee on methods of measuring detonation of the co-operative fuel research steering committee. It was prepared by the chairman of the subcommittee with the co-operation of the members. The membership of the subcommittee is as follows: D. P. Barnard, Standard Oil Co. of Indiana, Whiting, Ind.; T. A. Boyd, chairman, General Motors Corp., Detroit, Mich.; H. K. Cummings, Bureau of Standards, Washington, D. C.; H. C. Dickinson, Bureau of Standards, Washington, D. C.; Graham Edgar, Ethyl Gasoline Corp., Yonkers, N. Y.; J. Bennett Hill, the Atlantic Refining Co., Philadelphia, Pa.; H. L. Horning, Waukesha Motor Co., Waukesha, Wis.; Neil MacCoull, The Texas Company, New York, and C. B. Veal, secretary, Society of Automotive Engineers, New York.

Three things are essential to a uniform method of measuring the antiknock qualities of fuels: First, a standardized engine and accessories; second, a common reference fuel or scale of fuels; and, third, a uniform procedure. The first of these, an engine, has been designed and built; and by comprehensive co-operative tests it has been found to be, in the main, suitable for the purpose. Development work is being done on the three essential engine accessories: Means of carburetion, power-absorbing media and instrumentation. The second item, a reference scale, has been tentatively settled upon by adopting as recommended practice the use of mixtures of normal heptane, a hydrocarbon of low antiknock quality, and iso-octane, a hydrocarbon of high antiknock quality. A large amount of experimentation has been done on the item of method, but no specific procedure has yet been adopted. The chief activity on method has been rather in the experimental evaluation of the outstanding variables, such as spark timing, mixture ratio, fuel composition, and the like, which influence the measurement of detonation. The subcommittee has held 22 meetings, 16 of which have been attended by all of its nine members. Co-operating in this endeavor is a similar group in England.

There are three things, all of which are essential to a uniform method of measuring the antiknock qualities of fuels. These are, first, a standardized engine and accessories; second, a common reference fuel or scale of fuels; and, third, a uniform procedure. Although only the engine appears to have been specified in the original assignment to the subcommittee on methods of measuring detonation, all three of these items have been receiving the attention of the group in the order named. The reason for this is that all of these items enumerated are so intimately associated that they cannot be effectively separated from one another.

The antiknock value of a fuel obtained in any given case is determined not altogether by the properties of the fuel under test. It may be, and often is, affected in large degree by the engine and by the conditions and method under which the engine is operated, as well as by the composition or characteristics of the standard with which it is compared. Thus, the percentage of benzol in a given fuel that is equivalent in knock rating to some given concentration of lead tetraethyl in the same fuel is not a uniform quantity irrespective of the conditions of test. It is affected in large degree by the carburetor setting, by the spark advance, by the temperature at which the determination is made, and by other factors as well, such as the composition of the basic fuel used in the tests. Inasmuch as the measurement of detonation is thus not at all a simple matter, it has been the aim of the subcommittee to arrive at a combination of apparatus, method and reference scale which will yield results approximating as closely as possible those obtained in representative service.

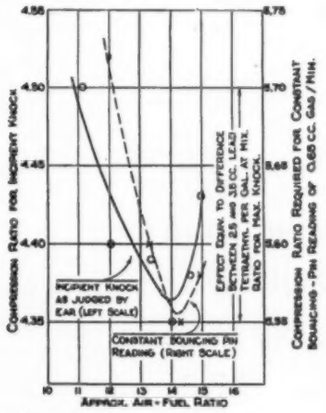
Compression Ratio for Incipient Knock
Compression Ratio Required for Constant Bouncing - Pin Reading of 0.65 cc. Gas / Min.
Incipient Knock as Judged by Ear (Left Scale)
Constant Bouncing Pin Reading (Right Scale)
Effect Equiv. to Difference Between 2.5 and 3.5 cc. T.E.L. Content per Gal. at Mix. Ratio for Max. Knock
Approx. Air - Fuel Ratio

Figure 1—Effect of mixture ratio upon knock.

Engine

The first concern of the subcommittee was that of providing an apparatus which would put everyone on the same basis in respect to the first important item. They accordingly pooled their experiences in the measurement of detonation, and on the basis of the result drew up specifications covering what they believed to be the essential features of a tentative engine. Both a variable compression and a fixed compression model were included. Engines conforming as closely as possible to these specifications were then designed by H. L. Horning, and a small number were built in his factory and distributed to the laboratories of the subcommittee members. A description of these engines in the form in which they existed at that time was given by Mr. Horning in a paper presented at the annual meeting of the American Petroleum Institute a year ago. Since that time a large amount of experimentation has been done with both types of this engine.

As is usual with new mechanical equipment, the experiences of these various tests pointed to certain changes that it appeared desirable to make in the engine. The concrete suggestions of each member of the subcommittee have been submitted to Mr. Horning. He has tabulated these, and is now engaged in incorporating into the engine such of them as are consistent with good design and with the plans for a knock-testing engine that is expected to have universal application. With respect to the changes that have been suggested, it should be said that none of them relates to the fundamental character of the engines, which in the main appears to be suitable for the purpose. Since none of the suggested modifications is of a fundamental nature, it is hoped that approval of a tentative engine can be made now before long. The elements of cheapness, ruggedness and dependability are being kept uppermost in the engine development.

Besides the engine, there are three accessories which are especially essential to a knock-testing apparatus: (1) A means of carburetion, (2) a power-absorbing medium, and (3) an indicating device. A great deal of experimentation has been done by the subcommittee on each one of these items also.

Carburetor

The importance of the first of these, a suitable carburetion system, arises from the large influence of mixture ratio upon tendency to knock. This is illustrated by the chart, Figure 1. The solid curve on this diagram referred to the scale at the left is in terms of compression ratio for incipient detonation, as determined by ear. The broken curve referred to the scale at the right is in terms of the compression ratio required to give a constant gas evolution of 0.65 cc. per minute by the bouncing pin indicator. Both curves show the same thing, viz., that a variation in mixture ratio over the ranges shown by the horizontal scale produced a variation in knock rating equivalent to the effect of 1.0 cc. of lead tetraethyl per gallon.

It is thus essential to accuracy in the measurement of detonation that the knock-testing apparatus be equipped with a suitable means for adjusting mixture ratio, and also that the metering of successive charges be just as uniform as possible. Some of the carburetor problems, particularly that of uniform metering, are harder to solve for a single-cylinder engine than for a multicylinder one.

The important matter of developing a suitable system of carburetion for the knock-testing engine has been delegated to a group with special capabilities in that field.[1]

Power-Absorbing Media

The problem of the second essential accessory, a suitable power-absorbing medium, cannot be finally solved until the specific method that is to be used for measuring detonation has been settled upon. Nevertheless, enough information and experience have already been obtained to make it appear that, when the time comes to do so, the matter of deciding upon a suitable means of absorbing the output of the engine will not be a difficult nor a time-consuming one. On account of especial suitability for controlling engines during general experimentation work, electric dynanometers have thus far been used as power-absorbing media in this development. However, the conventional electric dynanometer is perhaps too expensive and requires too much in the way of auxiliary equipment to be suitable for incorporation into the ultimate knock-testing.

One very desirable, and for most methods quite essential, characteristics of a power-absorbing medium for use in knock testing is a means of controlling engine speed and of holding it substantially constant. In the effort to take some of the burden of speed control off the operator, as well as to get a more exact regulation of speed, a considerable amount of experimentation has been done with such power-absorbing media as water dynanometers, synchronous motors, and induction motors. The latter have usually been run at only a fraction of their total capacity, so that the variation in slip with small changes in engine output is practically negligible. They, therefore, run at substantially constant speed. The water dynanometer did not work out so well in this respect, but either form of the constant speed electric motor does take the burden of speed control off the operator, and so both simplifies knock-testing technique and helps to make the measurement of detonation more rapid. Without special provisions for it, these motors are not adapted for measuring engine output, only for absorbing it. But, if the method of test finally settled upon should require engine power to be measured, the ability to do so could be obtained by cradling the motor used and making such other provisions as are necessary.

Instrumentation

The third essential accessory to a knock-testing apparatus, some form of instrumentation, is one that much work is being done on both by the detonation subcommittee and by others. No decision on the item of instrumentation has been reached as yet, however; for instrumentation is closely tied up with method, and the method must necessarily come after the engine. Instrumentation is so intimately associated with method that the method of test which it is best to use may ultimately hinge in part upon

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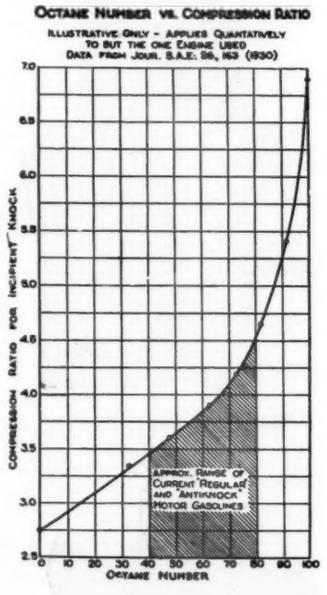
Octane Number vs. Compression Ratio
Illustrative Only - Applies Quantatively to But the One Engine Used
Data from Jour. S.A.E. 26, 163 (1930)
Compression Ratio for Incipient Knock
Approx. Range of Current Regular and "Antiknock" Motor Gasolines
Octane Number

Figure 2.

*Paper presented at eleventh annual meeting, American Petroleum Institute, at Chicago, Ill., November 12, 1930.

[1]This group is composed of D. P. Barnard of the Standard Oil Co. of Indiana, chairman, D. B. Brooks of the Bureau of Standards, and the following carburetor experts who have consented to assist in this work: O. C. Berry of the Marvel Carburetor Co., S. C. Kegerreis of the Tillotson Manufacturing Co., and F. C. Mock of the Bendix Aviation Corp.

Shutting off waste

Until drilling for petroleum became an industry, men's knowledge of oil, gained only from observing it in those few places where it happened to reach the earth's surface, was curiously superstitious. So fires, burning apparently of themselves, in the region of the Caspian Sea, were worshipped long before the Christian era. So in 1775 George Washington dedicated to the country, as a National Park, a tract of land on which had been discovered a burning spring.

Burning oil still remains a spectacle: exciting not awe, but an appalling sense of waste. Ever since the oil age began oil men have concerned themselves with developing means of controlling this waste.

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Equalling the serviceability of their design is their strength. The alloy steel of which their bodies and bonnets are made is manufactured by the basic electric furnace process. After the risers have been removed, each casting is thoroughly and uniformly heat treated to refine the grain and relieve cooling strains. This imparts to the castings those qualities that are so necessary under severe service—malleability, strength, and resistance to erosion. To assist oil men to get the greatest service and efficiency out of piping installations, Crane Co. maintains a group of experts . . . to command their knowledge and experience, wire or write Crane Co.

1855
SEVENTY-FIFTH
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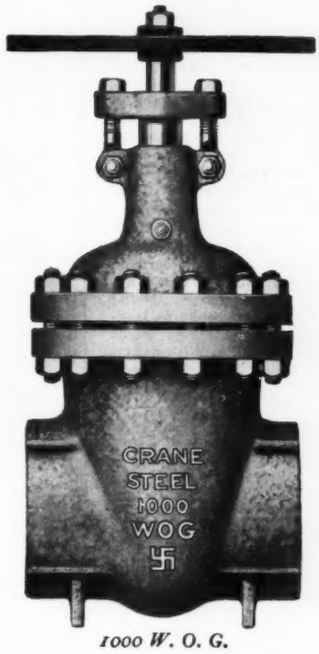
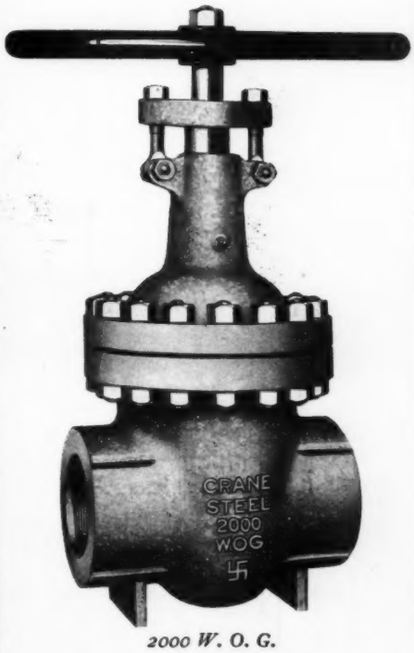


1000 W. O. G.

2000 pound test alloy steel manifold-flow line gate valve, 68-S



2000 W. O. G.

3500 pound test alloy steel manifold-flow line gate valve, 84-S

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Flue Gas for Reducing Fire Hazard

Presence of Explosive Mixtures Discussed and Methods for Its Solution Suggested. Three Economical Systems

By A. E. Pew, Jr.
Sun Oil Co., Philadelphia*

THREE SYSTEMS SUGGESTED

Following a policy of intensive development of methods and procedures for the elimination of potential causes of fires in oil refineries, the problem of preventing the presence of explosive mixtures is discussed and methods for its solution suggested. Three practical and economical systems are described.

One of these methods consists in the use of gas as an enrichment agent and as the displacement medium in tank breathing, thus eliminating the presence of air. The second and least used method consists in forced circulation of air through tanks containing small percentages of dissolved gases, thus preventing the tank atmosphere exceeding the lower explosive limit. The third and most widely applicable method consists in the generation of flue gas and its use to purge air or oil vapors from various types of refinery equipment, including tank ships and barges.

The hazards eliminated are the danger of discharge from static and bound charges, the spontaneous ignition of pyrophoric iron and sulphur corrosion compounds, all being ignition agents in the presence of explosive atmospheres. The flue gas system makes equipment safe for repair and inspection without the use of steam.

The purpose of this paper is to describe various methods of combating fire hazards by elimination of explosions resulting from the presence of explosive mixtures of hydrocarbons and air in containers of various types used in the oil refining industry. Special emphasis is given to the use of flue gas for this purpose, with a general description of methods used when flue gas is not practical.

The presence of explosive atmospheres in containers is not in itself a particularly hazardous condition; but when considered in connection with the many unknown factors of static charges, bound charges, stray currents, pyrophoric iron-sulphur compounds, any of which might cause the ignition of the explosive mixture and some of which are always present, a real hazard exists. The conveyance of nitroglycerin in an automobile is not particularly dangerous, providing it is not subjected to shocks; but it is not an occupation generally found desirable. We feel much the same way in connection with explosive mixtures of air and gas or vapors.

The elimination, to as great an extent as practicable, of conditions making it possible for static charges to accumulate, should be attempted by establishing permanent recording stations in refineries to learn the exact situation. Data thus obtained will indicate the proper steps to be taken to ground such lines as are collectors of stray currents, and even to eliminate the electrical leakage at its source.

The use of aluminum wires in agitators to neutralize the static field above the oil surface, the proper bonding of trolley lines where they cross the railroads entering refineries, track bonding, car bonding, etc., remove substantially the hazard of explosive mixtures by eliminating the factor which causes them to explode. But such methods are not practicable, or even possible, in the great variety of refinery operations.

Efforts were, therefore, directed towards preventing the formation of explosive mixtures in operations not susceptible to being safeguarded by static and bound charge elimination. The increased use of vapor-tight steel-roofed tanks, fractionating towers, gas recovery systems, and high sulphur crudes accounts for the importance of this problem.

The hydrocarbon vapors normally present in oil refineries are explosive when their concentration in air is between 1 and 15 per cent. Higher concentrations tend to burn, but not to explode. The following table shows limits of explosibility of various hydrocarbons:

Hydrocarbon—	Lower limit (per cent)	Upper limit (per cent)
Methane, CH_4	5.30	14.50
Ethane, C_2H_6	3.20	12.50
Propane, C_3H_8	2.40	9.50
Iso-Butane, C_4H_{10}	1.65	....
N-Butane, C_4H_{10}	1.90	8.50
Iso-Pentane, C_5H_{12}	1.32	....
N-Pentane, C_5H_{12}	1.40	8.00
N-Hexane, C_6H_{14}	1.14	....
Ethylene, C_2H_4	3.00	22.00
Propylene, C_3H_6	2.13	....
Iso-Butylene, C_4H_8	1.61	....
Amylene, C_5H_{10}	1.30	....
Acetylene, C_2H_2	2.60	73.00
Hydrogen, H_2	4.00	80.00
Carbon monoxide, CO	1.00	72.00
Gasoline vapor	1.50	6.00

The above data are taken from various sources, including International Critical Tables. In all cases the maximum range is listed. Prevention of explosive mixtures may be accomplished by increasing the percentage of the hydrocarbon constitution above the upper limit, by diluting the mixture below the lower limit, by increasing the air percentage, and by lowering the oxygen content by the use of an inert gas such as flue gas. All three procedures are used, as conditions do not permit any one to be a "cure all," but the latter system has the greatest variety of application. The use of the first two will be briefly outlined.

Receiving tanks, being subject to constant variations in quantity contained, show explosive mixtures in a great number of cases. In most modern refineries such tanks are connected to gas-recovery systems. It is thus very easy to interconnect these tanks with the lean gas

*Presented at Eleventh Annual Meeting, American Petroleum Institute, at Chicago, Ill., November 12, 1930.

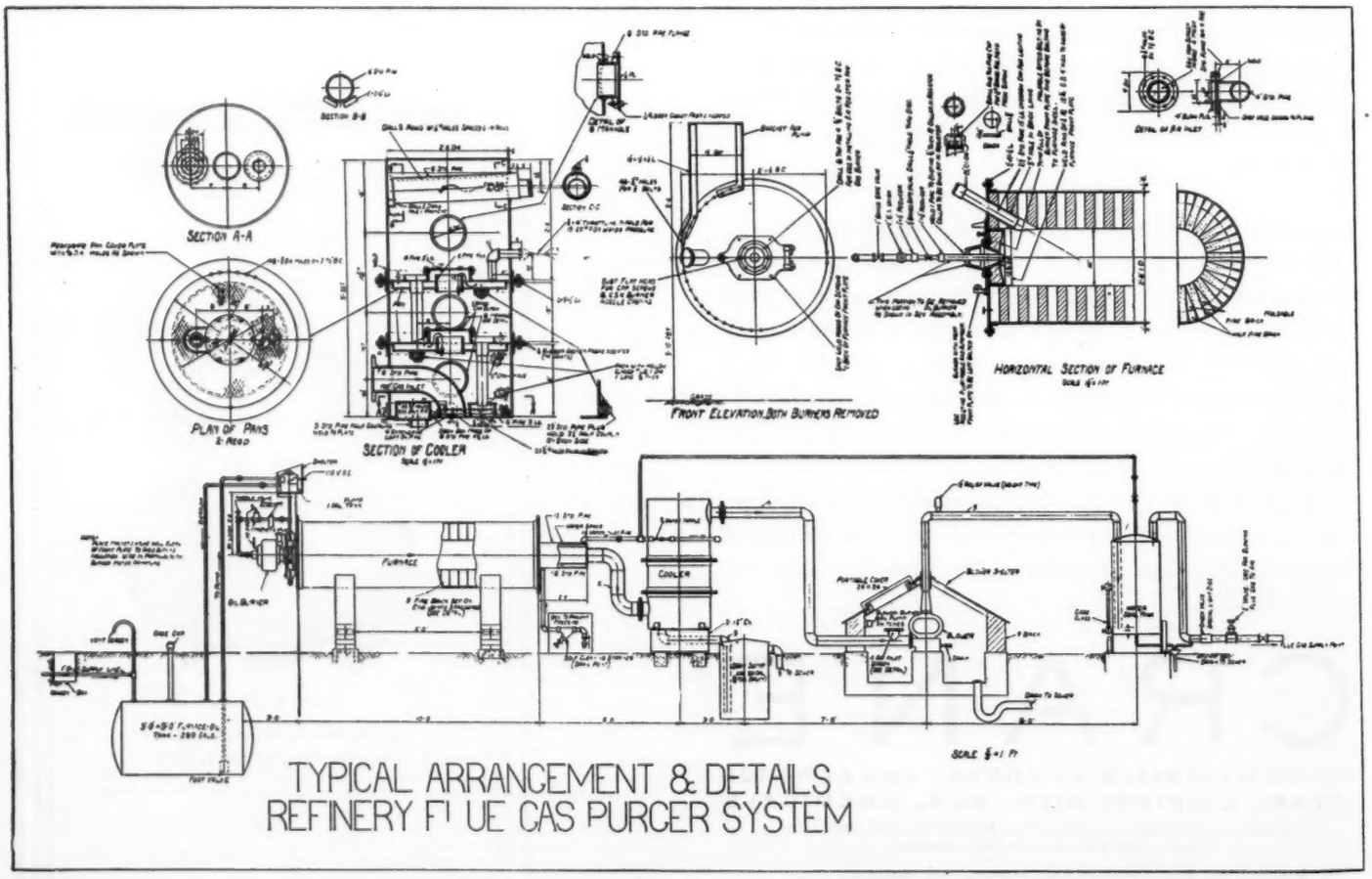

Figure 1.

IDECO

BOYKIN

ROTARIES

The greater depths of drilling have necessitated the development of more powerful drilling machinery. IDECO engineers have designed, perfected and field-proven our new IDECO 27½-inch Oilbath Straight Rotary. We recommend it for the 10,000 foot wells.

Because of the many economies obtained through their use, many operators prefer the make and break type rotary. IDECO-BOYKIN Make and Break rotaries were among the first in the field and have no equal. They are built in 19", 23" and 27" sizes.

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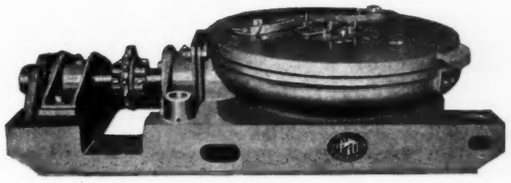
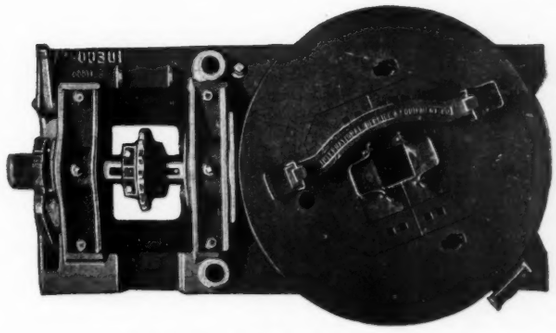
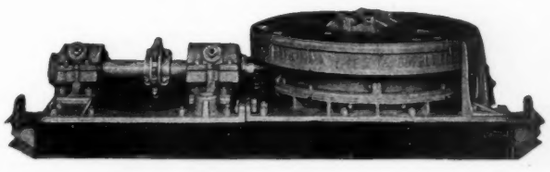


IDECO 27½" Oilbath Straight Rotary



Top view of Oilbath Straight Rotary



"Make-and-Break" Rotary, 19", 23" and 27"

INTERNATIONAL DERRICK & EQUIPMENT COMPANY — BOYKIN — IDECO

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Falls, Grand Saline, Seguin, Hebbronville, Pettus, Beeville, Texas; Lake Charles, Shreveport, Zwolle, Louisiana; Smackover, El Dorado, Arkansas; Bakersfield, Taft, Torrance, California; Hobbs, New Mexico.

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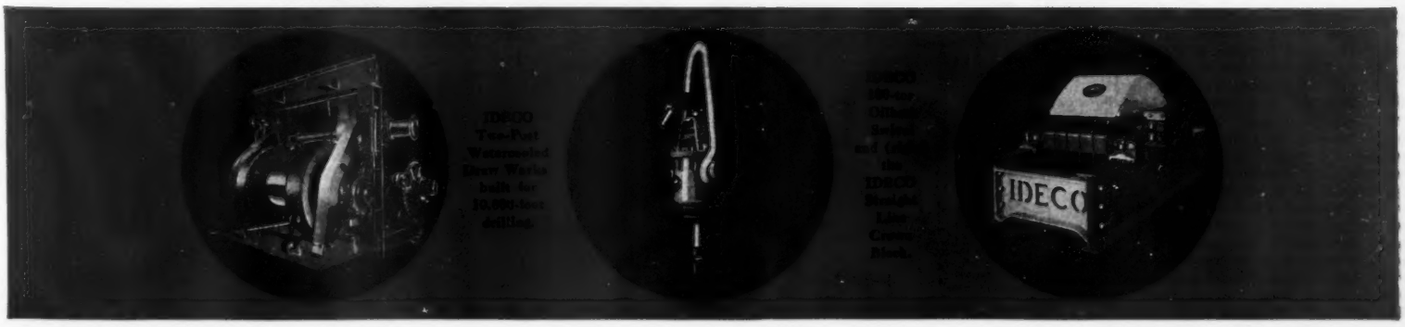

holder and, by the use of automatic valves, allow the gas from the tank to pass to the compressor when the tanks are filling with oil and then, when pumping out, to fill the void with lean gas from the gas holder. Two of our refineries are substantially completely equipped in this manner, and the results have been most satisfactory—no explosive mixtures having ever been found since the system has been used. The saving in vapor recovery also is a substantial extra benefit. Before this method was used, we had tanks which were fully equipped with steel roofs and breather valves explode while pumping out, with definite evidence that the explosion was due to the existence of a small volume of explosive mixture near the breather valve—this being ignited by the oxidation of sulphur-iron compounds on the steel roof. These explosions were not violent, but tore off one or two roof plates resulting in the ignition of the tank's contents. By preventing the access of air, this hazard has been eliminated. The use of this method is limited to tanks whose contents are not subject to rigid flash specifications, as we have found that the light gas used has a tendency to lower the closed cup flash of the product without affecting the open cup flash. Receiving tanks for gasoline, re-run naphthas, cracking stocks, re-cycle stock, etc., are the logical field for this application. Tanks containing finished light oil products are not subject to the presence of sulphur-iron compounds, and thus not so susceptible to ignition in the event of the presence of explosive mixtures. We have made no protective installations on such tanks, other than for vapor-purging purposes as described later.

Heavy fuel oil and lubricating oil tanks have never shown the presence of explosive mixtures and, accordingly, are not discussed in this paper.

Removing Hazards

Some tanks, such as receiving tanks for pressure still bottoms, are a hazard due to the presence of small amounts of residual gas in the oil, especially where vapor-tight roofs are used with conventional breather valves. These tanks show explosive mixtures on the lean side. Our practice in this case is to use a small rotary air blower, operated continuously or intermittently as conditions require, to keep up circulation in the tank and prevent the accumulation of gas responsible for the explosive condition. The quantity of gas is very small, and does not warrant connection to the gas system. A 500-foot per minute blower operating at 1½-inch water pressure with a one-half horsepower motor, costing installed $115, is ample for an 80,000-bbl. tank under our conditions. The same system is used on gas oil receiving tanks from crude stills when iron-sulphur compounds liable to oxidation are not present.

The applications so far discussed outline, in general, our use of the method involving enriching the hydrocarbon content of an air-vapor mixture above the upper limit of explosibility, and the method of increasing the ratio of air to hydrocarbon content below the lower limit.

As all operators know, a major problem to be faced in refinery operation is that of gas-freeing containers for inspection and repair after shutdowns, and freeing them of air before starting up. The use of flue gas for this purpose has been adopted by our company and extensively used during the past year. The system has been an entire success, and, due to the ease and simplicity of operation, is believed to offer a wide application both for refineries and ships.

The method consists in the generation of an inert gas as a product of combustion, viz., "flue gas," having a carbon dioxide content of approximately 9 to 13 per cent, oxygen 2 to 8 per cent, and the remainder chiefly nitrogen. The gas is generated in a furnace, and cooled in a water washer which also removes the soot and corrosive sulphur dioxide. The gas is then used to displace air or vapors in the container to be conditioned. The displacement is considered complete when exhaust gases from the container check with exhaust gases from the generator. Tests show that, with a flue gas containing as low as 6 per cent carbon dioxide and as high as 12.7 per cent oxygen, explosive mixtures are not formed with gasoline vapors in concentrations of from one-half per cent to 90 per cent. This clearly indicates that, even with exceedingly poor combustion in the generator, it is possible to obtain absolute safety.

Generators Used

The generators used for both land and marine purposes are essentially the same. Figure 1 shows a typical generator. The unit consists of a fuel or gas burner system, a furnace, a water cooler and washer, a blower and a seal tank. The drawing gives dimensions and complete details for a unit having a capacity of 180 feet of free gas per minute against a discharge pressure of three pounds per square inch. Such a unit is adequate for most refinery purposes, and is installed permanently. Our practice is to install one such generator to protect four pipe still units, one per unit of twelve 1,000-bbl. cylindrical stills, one for two lubricating oil plants, each plant having 10 towers and 10 vaporizers. The flue gas is carried through a manifold connecting into the base of the fractionating tower just above the maximum oil level. The purger thus washes the tower, condensers, gas separators, and lines, following the same flow line as the oil does in operation, and leaving the system through the gas stack or receiving tank vent. The system is used before starting up the tower, and when shutting down thus displacing air in one instance and gas in the other. Tar stills or other stills charging batch hot oils are filled with flue gas before and during charging, thus removing all air. The time required to displace air before starting depends, obviously, upon the size of the container and the generator. The quantity of flue gas required for air-purging a container is about 2½ volumes, and for gas-freeing an oil tank or gas holder 3¼ volumes are used. These quantities hold, in general, for the different units we have installed.

A container which has been washed with flue gas cannot be entered by men until it is freed of the gas. This is accomplished by shutting off the fire in the generator and allowing the blower to force air into the container. If the container has manholes or hatches, these are usually opened. Flue gas being heavier than air will, for example, leave a tank by the bottom manhole and air will enter through the top hatch. The use of the blower to force the air into the tank gives circulation and speeds up the purification operation. From 1½ to 2½ volumes of air per tank volume results in a safe condition. Containers thus prepared are always tested before men are allowed to enter. Flue gas will not supply enough oxygen for respiration, and may contain some carbon monoxide. Suffocation is more apt to result from exposure to the flue gas than is poisoning from exposure to the carbon monoxide. The use of the iodine pentoxide method gives a quick and accurate test for carbon monoxide, while the regular Orsat method is used for testing the carbon dioxide content. We have had no accidents of any kind in this connection, but attention must be given to the potential hazard in operating instructions.

Inflammable Gases

Tanks which are being emptied for repairs are gas-freed by the use of flue gas, blowing it in at the bottom through the swing line or through a special connection and allowing it to exhaust through the flame arrester on the regular breathing valve. This is important, as at the beginning the gases are inflammable, though not explosive.

Most large refineries which have cracking plants use gas holders for the lean gas. These holders from time to time require inspection and repairs, as does the gas-piping system. The gas holders used by our company are of 65,000 feet capacity, 38 feet in diameter, and 70 feet high, with hemispherical heads, operating at 50-pound pressure. These holders are carefully inspected for cor-

(Continued on Page 247)

SAFETY MINDEDNESS PROFIT FACTOR IN MARKETING PETROLEUM PRODUCTS

By G. S. Boetsma
Standard Oil Co. of New Jersey, Newark, N. J.*

Sacred history records the following dialogue: "The Lord said, 'Where is Abel, thy brother?' Cain answered and said, 'I know not; am I my brother's keeper?'"

Less than two decades ago this denial of responsibility in the form of a question expressed the attitude of industry in common toward the man who "earns his bread by the sweat of his brow."

Let me be frank at this point, gentlemen. While I am listed as speaking on "Safety Mindedness, a Profit Factor in Marketing," I do not propose to prove this by statistics, dividend rates, or per share earnings. But I shall be decidedly disappointed if there is not agreement among you when I have finished that an attitude of mind on the part of both man and management which promotes general safety is a factor of no small importance in the marketing of petroleum.

It is assumed there is no doubt in your minds that there is profit in the functioning of this Institute. Yet no statistics are submitted to prove what you accept as a fact—that the American Petroleum Institute is a profit factor to the industry in a broad sense.

Here is an industry which produces and delivers to the consumer annually untold millions of barrels of "liquid TNT." It is carried through streets teaming with humanity, in vehicles which depend for their propulsion on the explosive power of the product itself. Anything less than unremitting effort to be safety-conscious in such an industry as ours would be plain criminal carelessness.

I submit these equations: A profitable industry is an efficient industry; an efficient industry is a safe industry; hence, a safe industry is a profitable industry.

Human Safety

We have finally arrived. We are at last thinking in terms of human safety, and are pleasantly surprised to find it profitable.

The Supreme Court of Ohio in 1921 said: "Originally this doctrine (conservation) was largely applied to mines, forests, water power, and natural resources; later it was extended to hogs, cattle, buffalo, and wild animals generally; and, strange to say, lastly, it was applied to human beings."

A superficial perusal of vital statistics convinces us that, in spite of wonderful progress, our work is not accomplished. We still hear the ever-lengthening roll call of accidental death upon our highways, in our industries, at sea, and in our homes. A shadowy host of 97,000 accidentally killed last year marches before our vision (if Sherman had lived today, he would not have characterized war as he did), while the shadow of physical injury fell across 10,000,000 homes in the same period.

We are face to face with the awful fact that this procession of dead who might have lived was longer last year than ever before in our history. Never-

(Continued on Page 250)

*Presented at eleventh annual meeting, American Petroleum Institute, at Chicago, Ill., November 12, 1930.

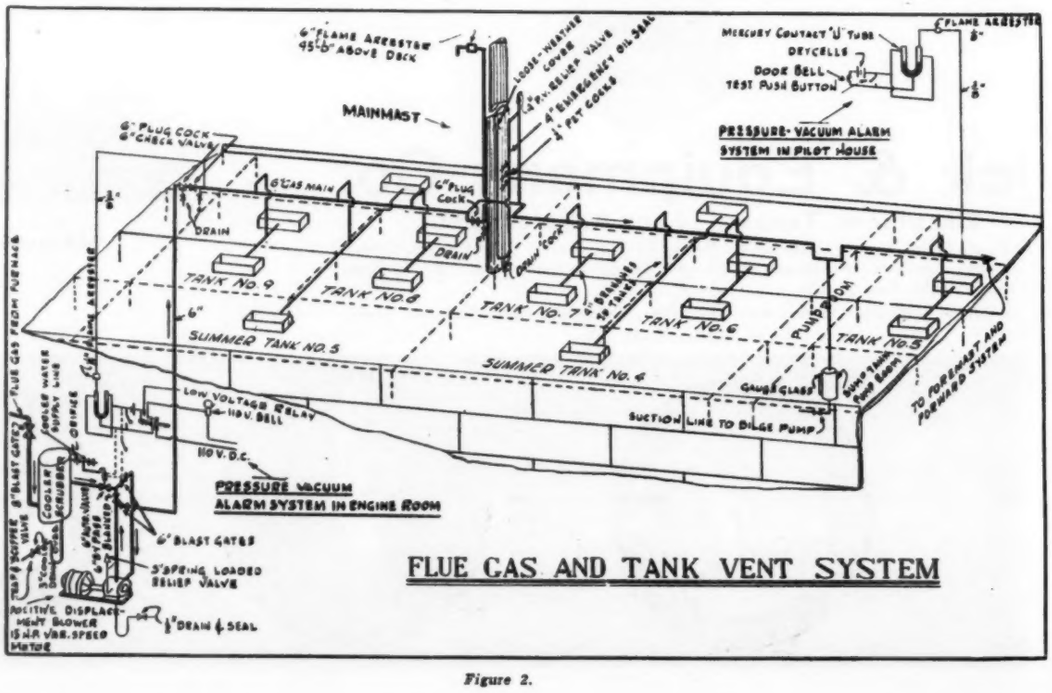

Figure 2.

Over 3 million

people have the opportunity to hear about

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SUMMER HEAT

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THE program of the Be Square on the Air is presented from the Barnsdall station KOIL over the Columbia Network, each Sunday evening. Reaching thousands of motorists that could be YOUR customers, telling them about BE SQUARE *Stabilized* Motor Oil, the all year round lubricant. Refined by processes exclusive to Barnsdall that for the first time make possible motor oils *Stabilized* for winter cold or summer heat. Now is the time to display the Blue BE SQUARE, to identify you to this tremendous audience Barnsdall is reaching through the radio and newspaper advertising.

Refineries: BARNSDALL, OKMULGEE, WICHITA

Sales Offices: TULSA, CHICAGO, NEW YORK, ST. LOUIS, KANSAS CITY, ST. PAUL, COUNCIL BLUFFS, IOWA, TOLEDO, LOS ANGELES, SAN FRANCISCO

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FIRST REFINER

Protecting Tankers With Flue Gas

System for Minimizing Explosion Hazards in Successful Use. Operation Is Adequately Safeguarded

By H. H. Hall
Standard Oil Co. of California, San Francisco, Calif.*

SYSTEM SUCCESSFULLY USED

A system by which flue gas removed from the boiler breechings is used for minimizing explosion hazards on tankers has now been in successful use in ships of the Standard Oil Co. of California for three years.

This flue gas system contributes to the safety of handling bulk petroleum products by eliminating the presence of explosive mixtures in cargo tank vapor spaces, and by removing all discharged vapors from the vicinity of the tanks while loading. Explosive mixtures are prevented by reducing the oxygen content of the tank vapor space; while vapors are collected by the same system of piping and discharged at the top of the mast.

A number of operating conveniences are provided by this system, including a ventilating system and a means for putting pressure on those volatile cargoes which might gasbind pumps while discharging. It is also indicated strongly that the use of flue gas is valuable in retarding corrosion.

The operation of the system is adequately safeguarded. A number of accessories have been developed to adapt the use of the system with the ordinary ship's routine.

The oil industry has every reason to be proud of its fire record. Considering the hazardous nature of the products handled, and the many times that they must be handled in passing from well to consumer, the low frequency of oil fires which was disclosed by an Institute survey some years ago made a very creditable exhibit. And on the Pacific Coast, at least, the general record during the past few years has been even better than the 10-year history compiled by the committee.

But one spot where the slate has not been quite so clean in recent years is in marine transportation. This is perhaps not surprising, for a tanker presents some of the worst fire and explosion hazards encountered in the industry. When the average tanker is loading, vapor is expelled onto the deck through the ullage holes, and workmen must walk to and fro regulating the flow of oil into tanks, adjusting the ship's lines and other equipment, getting back and forth from quarters, etc. Then, when the ship discharges, air is normally drawn into the tanks to replace the oil as it flows out; and there is frequently just enough oil vapor left in a tank to make, with the air drawn in, a violently explosive mixture. Usually such mixtures persist in this highly dangerous form until the ship arrives at its loading point, where they will be forced out onto the deck amid activities of the ship's personnel and other possible sources of ignition as mentioned above. Or if one compartment happens to have had a little extra amount of volatile oil left in the bottom, with the result that it contains a heavy rich mixture, this may, as it is forced out, form a "fuse" that reaches sources of ignition on passing crafts, bringing flame to other compartments containing explosive mixtures.

With such hazards to contend with, the relative infrequency of tanker explosions is a tribute to the skill and care of the operators. But despite their best precautions, there have been during the past few years a number of disasters, some of which have caused damage running into seven figures, such as the complete wrecking of a tanker in drydock, and many of which have resulted in loss of life.

Eliminating Hazards

While Standard Oil Co. of California's fleet has been fortunate enough never to have suffered such an explosion, the company has realized the danger under which tankers inherently operate, and several years ago company engineers started investigation methods by which the potential hazards could be eliminated. Realizing that an explosion cannot occur unless the oxygen of the air is present to combine with the petroleum vapors, the simplest and most direct way of eliminating the hazard appeared to be some means of filling the tanks with a gas which contained little or no oxygen.

Fortunately, no special appartus for the manufacture of such a gas is necessary on a steamship; for quantities of flue gas, from which the oxygen has been consumed in the boiler fires, pass up the stack whenever steam is being generated. This flue gas is, of course, a waste product which, when properly cooled and washed, makes an ideal inert gas for introduction into the vapor space of the cargo tanks.

The use of flue gas in fire protection is not new. The patent literature for various applications similar in general to the one under consideration runs back into the last century, but the patents deal almost exclusively with extinguishing fires. Its use in protecting solvent recovery plants from the formation of explosive mixtures was described by W. K. Lewis in Chemical and Metallurgical Engineering for March 1, 1922. In the petroleum industry, the Shell Oil Co. has used flue gas to protect its reservoirs for a number of years.

At first thought, putting gases from the boiler fires into a ship's tank might appear to be anything but a safeguard for the ship; but as the gases are withdrawn from the stack they flow through a washer in which a deluge of cold salt water brings the temperature of the gas down to practically that of the sea and washes out any soot that it may carry. As a still further safeguard, an automatic valve on the cooler outlet is held open by a steam piston against the pressure of heavy springs. Steam is supplied to the piston from the steam jet pumps used to pull the flue gas from the stack. Should the steam supply fail, the valve closes instantly. A connection is also made in such a manner that even partial interruption of the cooling water supply will release the steam pressure and permit the valve to close. Thus, no hot gas can possibly find its way into the cargo tanks, and vapor from the tanks cannot get back to the furnaces.

Three Safeguards

A flue gas system of the type described safeguards a tanker in three principal ways:

1. By keeping oxygen from getting into the tanks when they are emptied, it insures that during the period of unloading and return voyage the empty tanker's compartments are so thoroughly protected that they could not be ignited even if someone deliberately plunged a flame into them.

2. During the period of loading, the vapors, instead of being pushed through the ullage holes onto the deck, as is the case in an ordinary tanker, can all be collected through the flue gas piping system and discharged up and out the top of a hollow mast—or through a pipe run up along the mast if the latter does not happen to be hollow. Again, during the transportation of extremely volatile cargoes, such as casinghead gasoline, through warm sea water, pressure sometimes builds up in the ship's compartment to a point where more or less vapor must be relieved. This can be accomplished through the flue gas system by providing a by-pass around the mast valve in which is located a pressure actuated relief valve. This valve is set near the maximum pressure which the ship's tanks will safely stand, and operates to relieve the gas up the mast or stack before this maximum pressure is reached. Without such a system for disposing of the gas, it flows out on deck through the relief valves, and tends to accumulate in various parts of the ship, where it may create a serious explosion hazard.

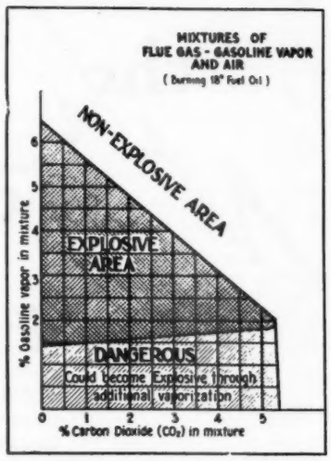

Chart showing status of flue gas-gasoline vapor mixtures.

Cleaning a Tanker

3. When it is desired to clean a tanker, flue gas can be blown into the bottom of the tanks through the cargo lines—at the same time washing down the sides with hot water from a rotating interior nozzle if desired; and the mixture of residual petroleum vapors and flue gas can be discharged through the flue gas lines up the mast. By this process practically all of the petroleum vapor can be quickly swept out of the tanks. Then, by means of a special connection through which air instead of flue gas is drawn into and forced through the circulating system, the flue gas can be displaced and the tanks filled with clean fresh air, ready to open up and work in. All this can be accomplished without having an explosive mixture in the tank at any time—a condition which cannot be avoided when the usual process is followed, of forcing in air by windsails, and gradually diluting the petroleum vapors that are in the tank when it is first opened. Some of the worst tanker accidents occurred during cleaning and re-

(Continued on Page 252)

*Presented at eleventh annual meeting, American Petroleum Institute, at Chicago, Ill., November 13, 1930.

NEED FOR OBTAINING ADVERTISING VALUE OF AUTOMOTIVE EQUIPMENT

By Charles H. McBurney
Marathon Oil Co., Tulsa, Okla.*

We have automotive equipment that is continually traveling around, through our cities and out over our highways, being seen by numberless pedestrians and travelers. In order to preserve the material in that equipment, it is only necessary to give it a good coat of some kind of paint; but, as it is continually moving among the people upon whom we depend for the sale of our products, with a very little additional expense we can attractively paint and letter that equipment so that each unit becomes a traveling billboard.

The cost of attractively painting and lettering a piece of automotive equipment would vary from $60 to $250. No doubt the argument will be presented that a truck after being out a short time will become dirty and badly worn, giving a very poor advertising value. Admitting that this is true, it must be conceded that the advertising value is sufficient to warrant the small additional amount necessary to keep the equipment freshly painted and lettered at all times, the cost of which would be slight as compared with the expense of billboard advertising.

Automotive advertising is a sign in motion, and it is a recognized fact that a sign in motion attracts more attention than an immovable sign; therefore, an attractively painted and lettered piece of automotive equipment should have its place in recognized advertising.

It is not contended that advertising on all automotive equipment is profitable, as in many industries there is equipment that never leaves the manufacturers' plant, and in the oil industry there are many pieces of equipment that never leave the lease on which they are in use. In cases of this kind they would be seen by so few people that the expense of attractively painting and lettering them would not be warranted. There are also some types of trucks on which it would be useless to attempt to apply advertising because of insufficient available space for that purpose. However, where it is possible to paint and letter attractively a unit that is traveling through the cities or over the highways, there can be no question as to its advertising value.

Real Issue

Inquiry among various operators of automotive equipment does not disclose much, if any, question as to the value of advertising on automotive equipment; but the real issue involved is the fact that the cost of this advertising is carried as an automotive operation cost instead of being carried as an advertising cost. This method of handling the cost, in many instances, is responsible for the very poor condition into which the paint and lettering on some units is permitted to deteriorate.

There is no question that in the end

(Continued on Page 166)

*Presented at eleventh annual meeting, American Petroleum Institute, at Chicago, Ill., November 13, 1930.

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Why and How of Pipe Protection

Co-operative Group of Coating Manufacturers Offers Suggestions. Protection Depends on Proper Application

By W. H. T. Thornhill
Secretary-Treasurer, Underground Pipe Protection Institute*

In making our initial appearance before the assembled members of the American Petroleum Institute, we are well aware of the oil industry's urgent need for practical, reliable recommendations which will aid in reducing the enormous losses caused by soil corrosion. As a co-operative group of coating manufacturers who have been active for many years in developing and putting to use effective materials for combating corrosion, we feel that it may be possible for us to offer a few worth while suggestions.

It is the intention of the Underground Pipe Protection Institute to co-operate to the fullest extent with other organizations which are actively interested in the prevention of soil corrosion, notably the American Petroleum Institute, the American Gas Association, the American Water Works Association, and, of course, the Government's Bureau of Standards.

Corrosion to Buried Pipe Lines

It should not be necessary to impress upon oil men the seriousness of the problem of soil corrosion to buried pipe lines. If this problem were an imaginary one, none of us would be here today; the oil companies would be millions of dollars to the good, and there would be no manufacturers of protective coatings for pipe lines.

As you are aware, numerous attempts have been made to show that the use of protective coatings for pipe lines is a waste of money. By various methods of argument, this contention is sometimes made to seem quite valid. However, the facts speak for themselves. Despite all theories and opinions, corrosion continues to destroy buried pipe—unless the pipe is adequately protected. Experience has proved that to ignore protection is to invite trouble and needless expense whenever steel pipe is buried in the ground.

It is an axiom that any buried steel pipe will fail eventually from corrosion, and from nothing else. It is assumed, of course, that the pipe line is constructed properly from a mechanical standpoint before it is buried, and that failure from this cause need not be considered in this connection. When buried in severely corrosive soil, the useful life of unprotected pipe will, of course, be relatively short. Under the most favorable subsoil conditions, this life will be prolonged to some extent. However, if unprotected steel is exposed, it is bound to deteriorate, resulting in a partial loss of investment, and eventually it will be destroyed by corrosion, resulting in a complete loss.

It is hard to believe there is any economic justification for such neglect. Even if operating conditions altered to the extent that a pipe line were no longer needed, it would be sheer extravagance to allow such an investment to be lost entirely. Any pipe has a substantial salvage value, if still in good condition, even if it no longer is needed in its original location. Protective measures, taken in time, will assure a distinctly satisfactory and sometimes surprisingly high salvage value.

Depreciation From Corrosion

In discussions regarding the economics of pipe line corrosion and protection, the amount and extent of actual failures from corrosion only is considered, and no attention given to the obvious depreciation from this cause that has taken place on the rest of the pipe line. Naturally, this is an item of extreme importance, and likely would alter the usual conclusions.

Protective coatings are bought in the belief that the additional investment will be justified by increased life of the pipe. This includes longer freedom from leaks caused by localized pitting, lower maintenance or operating costs, and, consequently, fewer flow interruptions and increased net revenue. Frequently, the lost net revenue from interruptions exceeds many times the cost of applying a good protective coating to the entire line when new. The extent to which this additional investment accomplishes these purposes is to be shown clearly in another part of this paper. However, there is a point which should be more clearly understood by users and prospective users of protective coatings. This concerns the correct method of absorbing or charging off this investment for protection.

Investment in Coating Protection

We have found many users of pipe who hold the opinion that interest on the coating investment should be compounded throughout the normal life-span of the uncoated pipe, and that it is only after this period that they begin to get any return on their coating investment.

Let us say, for example, and assuming arbitrary figures for the length of life, for the purpose of illustration only, that bare pipe in a given location will last 15 years; also, that a given protective coating will increase the life of the pipe six years. They calculate compounded interest at 5 per cent on the coating investment, over the initial period of 15 years, and then begin to absorb or charge off this greatly inflated investment figure at a time when uncoated pipe would have normally outlived its usefulness and would have to be replaced in its entirety. Such reasoning is obviously wrong.

The fallacy of this method of calculation is that it overlooks the fact that the life of bare pipe, when protected, is increased at the initial end of its life-span, and not at a time when it is beyond protection. Logically, the proper method is to carry the investment for protection and that for the pipe as a unit, charging off or absorbing both investments together over the full period of lengthened life of the line itself.

When viewed in this true light, the investment in coating is not only moderate, but it is the cheapest insurance that can be secured against loss of revenue and increased operating costs. It will be found that the cost of the material and the labor for applying a good pipe coating will run from about 2 per cent in the case of cold applications, to possibly 10 per cent in the case of some wrapped hot applications. These estimates are based on the total cost of a new pipe line, exclusive of compressor or piping stations.

Pipe Coating an "Insurance Premium"

Based on the estimate of many operators that the average life of unprotected pipe in the Mid-Continent Field can be taken as 10 years, it is seen that a good coating is a very reasonable "insurance premium." Even if the estimate of the average life of bare pipe is increased to 20 years, the cost of protection is still reasonable. It will be observed that the coating would only have to increase the life of the pipe a few years to justify its cost. Many coatings can be depended upon to do considerably better than this.

It is common knowledge that steel exposed to atmospheric or other corrosive conditions is bound to suffer deterioration from rusting. All-steel structures above ground are customarily protected against such deterioration by the application of a protective coating. If signs of failure develop later, it is a comparatively simple matter to apprehend and repair the trouble. Such structures, being above ground, can be easily observed and their condition readily checked from time to time.

How different are the conditions surrounding a buried pipe line! Being out of sight, it is both difficult and expensive to make even an approximate determination of its condition after it is once buried. Even if it is known that deterioration has set in, it is a matter of tremendous expense to dig up the pipe, recondition it, and then relay it. Consequently, it is obvious that the need of protecting such an investment is considerably greater than the protection of metal structures situated above ground. Since the latter are always protected, why make an exception of buried pipe lines, where the danger from corrosion is known to be much greater?

Sound engineering judgment and good business practice recognize the need for pipe protection. How to meet this need is the next question that arises. It is to be hoped that some day it will be economically feasible to build pipe lines of noncorrosive metals or alloys. However, it seems to be agreed by leading metallurgical authorities that this day is entirely too far distant to serve as a solution of the present problem.

Excess Wall Thickness Wasteful

Excess steel is the most expensive protection ever used to combat corrosion, as the industry is now beginning to realize. Sufficient steel thickness is required to enable pipe to withstand operating conditions, based on a reasonable factor of safety. Any excess wall thickness for the purpose of taking care of corrosion is extremely wasteful and of doubtful value. It has been found that wall thickness can be obtained exactly or very close to that required, resulting in a saving that more than pays for the material and application of a good protective coating. The present trend toward the use of thin-wall pipe, with more attention being paid to protective coatings, shows that this fact is recognized.

Just as it is generally known that steel is subject to corrosive action, it is also known that some materials which are relatively cheap are strongly resistant to such destructive forces. There is no other practicable alternative than to use these noncorrosive materials in compounds specifically designed to form an enduring material which will protect the buried metal from the corrosive influences waiting to attack it. Many years of research and experimentation have yielded various protective coatings, which, when properly applied to the pipe, can be depended upon to accomplish this desired result.

It is realized that there have been failures of protective materials in the past. This condition has created a certain amount of skepticism in some quarters regarding the worth of all pipe coatings. This is hardly a fair attitude. Many of the coating materials used in the past were offered by concerns lacking proper knowledge of the conditions to be met. It is equally true that good coatings that have been used did not have any opportunity to give real protection due to the fact that they were not applied properly. This is common knowledge.

An experienced engineer of a large pipe line company operating approximately 7,000 miles of underground steel pipe in

(Continued on Page 166)

*Presented at eleventh annual meeting, American Petroleum Institute, at Chicago, Ill., November 13, 1930.

MANUAL OF SAFETY PRACTICE FOR FIRE PREVENTION AND PRODUCTION

By C. H. Haupt
Standard Oil Development Co., Elizabeth, N. J.*

There seems to be no question that much of the industry's future growth, in the refining branch especially, must be influenced by its ability to overcome the increasing potential fire risk that attends larger units and newly developed processes. This problem starts with fundamentals, such as the selection of materials suitable for these conditions, which did not exist until recent years in the industry. To meet this necessity requires constantly an immense amount of research work along the lines of metallurgical analysis, together with elaborate practical tests of various alloys to determine which can be used safely under present-day conditions and which have possibilities for the future. Here too, the problem of corrosion is an ever-present source of uncertainty which must be guarded against, not only in the original selection of materials, but also in the constant inspection of apparatus during its service life. Unless such conditions can be successfully met by our metallurgists and our engineers, it will be impossible to realize in practical application the full value of the results obtained in chemical research. Although this problem is not peculiar to the oil industry, it still is an ever-present source of concern, and must be carefully considered in our designs, especially as all our products are of a flammable nature.

With the great variety of new equipment that is constantly being introduced and modified to suit the various crudes handled in refineries, and with the necessity of reducing, as never before, the cost of refineries to a minimum, as well as the costs of handling and storing products, there may be a tendency to take risks as regards fire hazards, and not to allow proper factors of safety in design, either through ignorance or the exigencies of competition.

Necessity for a Code

The investment in the oil industry in the United States today represents something in the neighborhood of $12,000,000,000. There are thousands of companies engaged in the oil business and hundreds of thousands of employees active in their service. The large number of stockholders in these various companies also increases the total of those directly interested in the prosperity of the business; and if we were also to include all those who are dependent in the normal course of their daily lives upon the products of the oil industry, it would include practically the entire population of the country.

It seems remarkable with a vast basic industry, such as that constituted by the oil business of America today, where raw materials and products are practically all of a flammable nature, that while we have many excellent codes among the individual companies, no attempt has apparently been made to codify or to standardize, in any general way, rules for fire prevention and protection of oil properties.

The basic problems in all the various

(Continued on Page 260)

*In collaboration with O. H. Gundlach, Sinclair Refining Co., New York, N. Y.; and W. W. Lowe, H. L. Doherty and Co., New York, N. Y. Presented at Eleventh Annual Meeting American Petroleum Institute, at Chicago, Ill., November 12, 1930.

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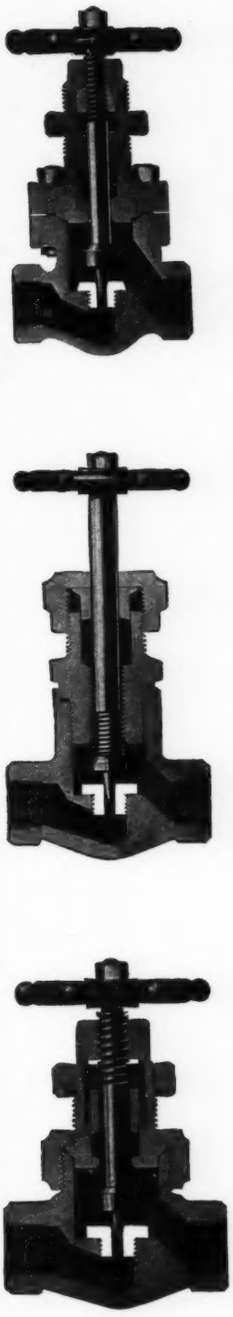

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Meaning of Gasoline Distillation Curve

Important Relationships Between Distillation Data and Performance of Fuel in Engine

By Graham Edgar,* J. B. Hill† and T. A. Boyd‡

ABSTRACT

The purpose of this paper is to discuss the more important relationships between the distillation data of gasoline and its performance in the automobile engine, as developed by the work of the Co-operative Fuel Research Steering Committee during the last few years and to emphasize certain practical principles which apply to the mutual problems of the oil refiners and the automotive engineer.

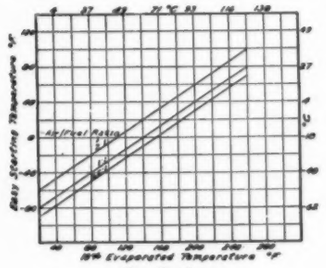
Motor fuel volatility relates to engine performance chiefly in the following ways: 1, ease of starting a cold engine; 2, tendency to interrupt operation because of vapor lock; 3, ease of acceleration; 4, relative ease of effecting a dry mixture; 5, tendency to crankcase dilution.

It has been shown that if the A.S.T.M. distillation curve of a fuel is known, its characteristics with regard to all five of these factors may be at least approximately calculated.

A study of the fundamental principles involved leads to several practical principles which may serve as a guide to the oil refiners in indicating the volatility characteristics which gasoline should possess to give satisfactory engine performance under various conditions, and to the automotive engineer in indicating methods by which the fuel feed systems of automobiles may be improved.

It has not been so many years ago since the oil refiner's entire vocabulary with reference to gasoline seemed to be limited to the words "initial," "endpoint" and "gravity" (none of which, by the way has any direct relation whatever to the performance of the fuel in an engine), while at the same time the automotive engineer seemed hardly conscious of the fact that fuel is as essential a part of an automobile as are wheels. There was perhaps some justification for this situation in the fact that little or no fundamental information existed relating to the performance of a fuel in an engine to its physical characteristics. Eventually, however, the fact was recognized that the automobile and its fuel constitute a joint problem, concerning almost equally the automotive engineer and the refiner; and out of this recognition came the formation in 1922 of the Co-operative Fuel Research Steering Committee, representing the American Petroleum Institute, the United States Bureau of Standards, the National Automobile Chamber of Commerce, and the Society of Automotive Engineers. Under the direction of this committee, fundamental research carried out at the United States Bureau of Standards has clarified many relationships of the properties of fuel to its engine performance, so that it is now possible to state with considerable confidence the properties which a fuel should have to meet given engine conditions, and to state certain fundamental principles of automotive design which are desirable for the type of fuel in general use.

While the work outlined above has been in progress, much valuable work along similar lines has been done by other agencies (e.g., G. G. Brown, Eng. Res.



Easy Starting.

Figure 1.

Bull. No. 14, Univ. of Mich., 1930). The present paper, however, is concerned only with the work done under the direction of the Co-operative Fuel Research Steering Committee, and will be further confined to the subject of volatility, as other important phases of this work will be treated elsewhere. No attempt will be made to go into detail, nor to discuss the data upon which the conclusions are based, as all of these matters are discussed in the various papers which are listed in the bibliography, which should be consulted for all experimental data, formulae, methods of calculation, etc.

Motor Fuel Volatility

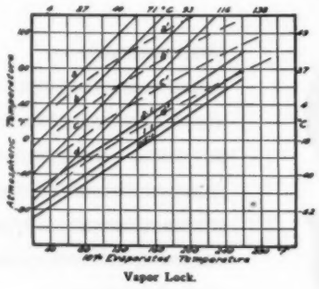
Motor fuel volatility relates to engine performance chiefly in the following ways: 1, ease of starting a cold engine; 2, tendency to interrupt operation because of vapor lock; 3, ease of acceleration, particularly during the warming up period; 4, relative ease of effecting a dry mixture; 5, tendency to crankcase dilution.

It has been shown that if the A.S.T.M. distillation curve (it should be emphasized that all these relations involve, however not the usual "per cent recovered" in the A.S.T.M. test, but the "per cent evaporated," which for any given temperature is equal to the per cent recovered plus the distillation loss) of a fuel is known, its characteristics with regard to all five of the above factors may be at least approximately calculated.

Ease of Starting

The ease of starting a cold engine (mechanical factors being assumed satisfactory) has been found to be determined: a, by engine temperature; b, by the air-fuel mixture supplies by the carburetor (with the choke on); and c, by the temperature at which 10 per cent (for the most exact calculations, particularly with very volatile gasolines such as natural gasoline, the slope of the A.S.T.M. distillation curve at the 10 per cent point is also involved; in the data given in this paper, average values of the slope have been employed) of the fuel is evaporated in the A.S.T.M. distillation.[5 9 10 13 13 14]

The quantitative relationships between these variables are illustrated in Figure 1. If we take as ordinates engine temperatures, and as abscissae temperatures at which 10 per cent of the fuel should evaporate (A.S.T.M.), Curve 1 gives the maximum 10 per cent temperature at which easy starting can be obtained with a carburetor supplying 0.5-1 air-fuel mixture; Curve 2, similar temperatures for a carburetor supplying a 1-1 air-fuel mixture; and Curve 3, for a 2-1 air-fuel mix-



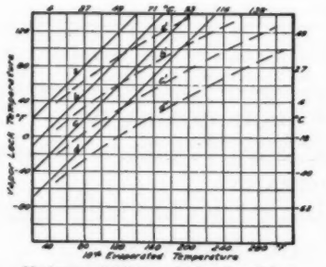
Vapor Lock.

Figure 2.

ture. It will be seen, for example, from Curve 2 that with a carburetor supplying a 1-1 air-fuel mixture, and at 10° F. atmospheric temperature, the gasoline must have its 10 per cent point at least as low as 156° F. to insure easy starting.

Vapor Lock

Vapor lock will occur when the fuel boils in any part of the fuel feed system up to and including the carburetor passages. This will occur when the temperature at any of these points becomes so high that the vapor pressure of the fuel exceeds that of the atmosphere. It has been shown that the temperature at which the gasoline free from propane will boil is equal to the A.S.T.M. temperature for 10 per cent evaporated.[11 14 15] If the gasoline contains appreciable propane, it will have an abnormally high vapor pressure and will, therefore, boil at a tem-



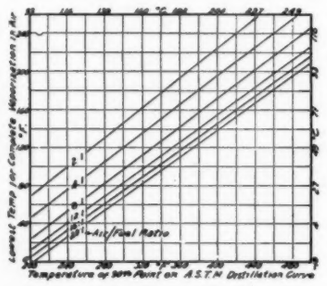
Maximum and Minimum 10 Per Cent Points.

Figure 3.

perature lower than that of the 10 per cent point. For such gasolines, the vapor pressure itself is a more accurate measure of the tendency to vapor lock than the 10 per cent point. For most gasolines, which are essentially free from propane, the 10 per cent point and the temperature which the gasoline may reach in the fuel system are the main factors determining the tendency to vapor lock.

Now the temperature which the fuel reaches in the fuel system is determined: a, by atmospheric temperature; b, by the conditions of operation (speed, load, etc.); c, by the location and design of the fuel lines and carburetor, and by such equipment factors as thermostats, radiator shutters, etc. Furthermore, the problem is complicated by several other factors. In the first place, the properties of the fuel in the fuel system may not always be identical with those of the fuel as supplied to the tank. A certain amount of evaporation of lighter ends (stripping) may occur in the fuel tank,[17] in the vacuum tank, and in the carburetor bowl itself, so that it is possible for the fuel to be heated somewhat above the temperature at which 10 per cent of the original fuel evaporates without vapor lock occurring. Again, the presence of sharp bends in the fuel lines, or abrupt changes in their diameter,[18] increases the tendency to vapor lock with a given fuel under given conditions.

Marked differences are then to be expected, and are found in practice, in the vapor-locking tendencies of a given fuel in different automobiles. A fuel which will operate with entire freedom from vapor lock in one automobile may give much trouble in another. It is, therefore, impossible to specify definitely the minimum 10 per cent temperature (or maximum vapor pressure) which a fuel should possess, without reference to the



Complete Vaporization.

Figure 4.

characteristics of actual automobile fuel systems. If we take atmospheric temperatures as ordinates and 10 per cent temperatures as abscissae, we could obtain for a series of given automobiles curves representing the minimum 10 per cent temperatures which the fuel must possess in order to avoid vapor lock. These curves approach as the ideal a curve in which the fuel does not rise above atmospheric temperature, and the ordinates and abscissae are, therefore, equal. (Similar curves could be drawn with maximum vapor pressures as ordinates.) The position of the curves and their exact form will vary with the design factors of the fuel induction system, and sufficient data are not available at present to construct accurate graphs; but the curves for different automobiles would have the general nature shown in the solid lines in Figure 2, where Curve a represents the ideal curve mentioned above, and Curves b, c and d represent increasingly badly designed fuel systems, in which the fuel is heated 30°, 60° and 90°, respectively, above atmospheric temperature. The dotted curves a', b', c' and d' are corresponding curves, showing the approximate effect of 2 per cent propane on these relationships.

Ten Per Cent Temperatures

If we combine Figures 1 and 2 as in Figure 3, it is clear that a fuel which will give both satisfactory starting and freedom from vapor lock in a given car must have its temperature for 10 per cent evaporated lying to the left of the proper curve for starting and to the right of the proper curve for vapor lock. Several important conclusions for both the automotive engineer and the oil refiner may be drawn from inspection of these curves.

In the first place, it is evident that the area between the curves, which determines the permissible range of 10 per cent points for satisfactory operation is determined by the propane content of the gasoline, the design of the fuel system, and the efficiency of the choke. For fuel systems approaching the ideal and for gasoline free from the deleterious propane, the range is extremely wide, even at low atmospheric temperatures. The range narrows as the fuel system becomes poorer; and at low temperatures, with a very badly designed fuel system and an inefficient choke, the vapor lock and

(Continued on Page 256)

*Ethyl Gasoline Corp., Yonkers, N. Y. †The Atlantic Refining Co., Philadelphia, Pa. ‡General Motors Corp., Detroit, Mich. Paper presented at eleventh annual meeting, American Petroleum Institute, at Chicago, Ill., November 12, 1930.

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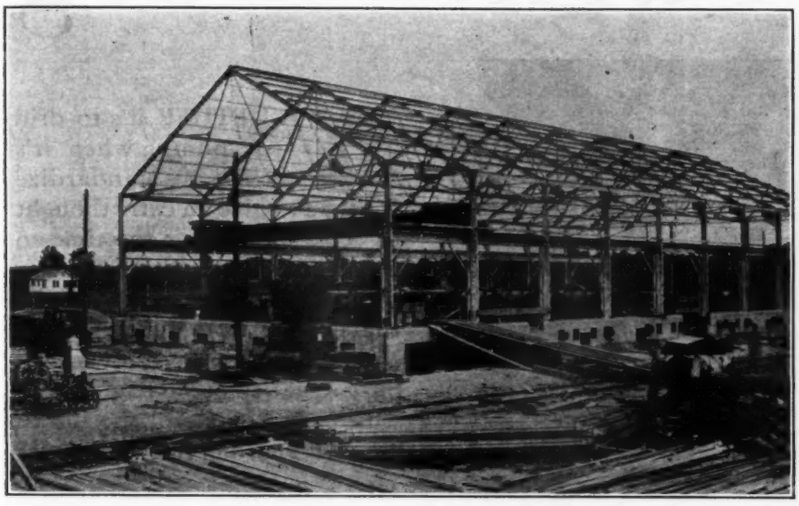

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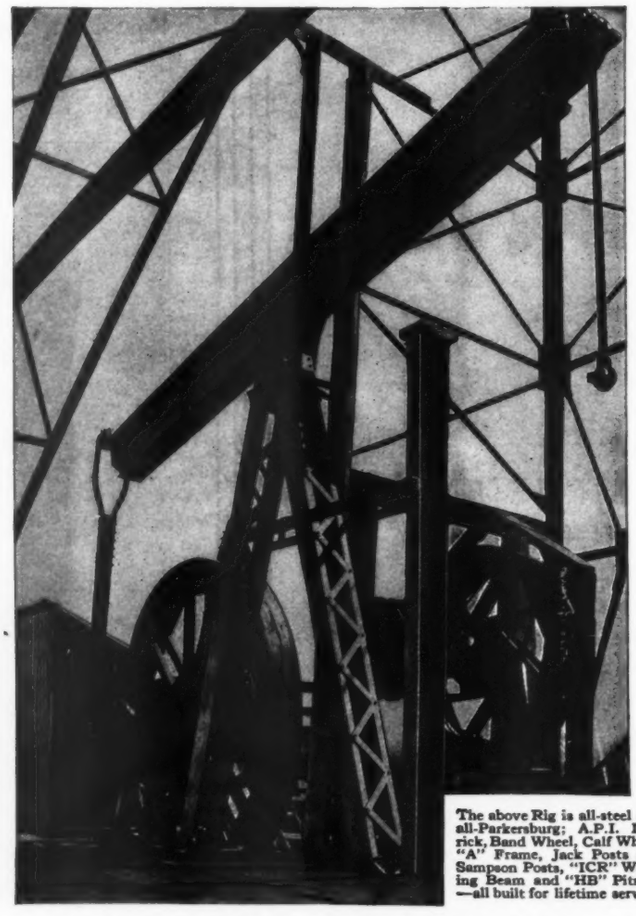

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Unitization Land and Lease Aspects

Policy Should Be Fostered by Discouragement of Currently Used but Noneconomic Alternatives

By John P. West
Prairie Oil & Gas Co., Tulsa*

SUBSTITUTE FOR PRORATION

Unit operation is in line with economic thought and an elaboration of the co-operation and conservation movement. It is an extension of the partnership idea; and is, legally and from all leasing standpoints, sound and practical. With encouragement it will eventually substitute for proration.

Its growth should be fostered by discouragement of other currently used, but noneconomic, alternatives. Its expansion in common practice is dependent on the mechanics of contracts and accounting being standardized, certain controversial questions eliminated, and principles of equity defined.

Its future possibilities of expansion are practically unlimited. Simplification to standard practices, under the auspices of the American Petroleum Institute, would make such expansion popular.

Industrial evolution of the past decade has distinctly trended towards economic co-operation. The oil business evidences this trend in the co-operative efforts that have resulted in the widespread movements in the orderly restriction of production of crude oil to available outlets, the reduction or avoidance of wasteful above-ground storage, the curtailment of throughput in refinery operations, and the agreements embodied in a code of ethics among marketers. Each of these movements has added its quota of results in stabilization of the industry, the cause of true conservation, and elimination of waste in efforts and resources.

Unit operation, commencing as it does at the inception of development, can and will do more than these other efforts automatically to effect conservation and prevent actual as well as economic waste, build up natural reserves of crude oil to assure adequate normal supply, and insure the nation in any emergency. Through judiciously planned drilling, more extensive utilizing of the energy of natural gas pressures, and economies of overhead expenses, recoveries can be increased, outlays decreased, and development regulated to avoid duplication of effort, resulting in enormously increased earnings to all joint owners in a project. The balance sheets of actual examples of unit operations prove these contentions, and conclusively show that, at any given time-stage of the field operations of a unit project, the ledgers will show credits in dollars and cents that are larger than those which could be normally postulated under severalty ownership.

Situation Needs Attention

No optimist but will concede that the oil business is one of the sick industries of the present world-wide depression. The palliatives of proration—emptying of storage and reduction of throughputs—have prevented the debacle; but unrestricted drilling without proper safeguards has pyramided the evil of wasteful overproduction.

Close students of the situation believe that it will be years before the expedient of proration can be safely abandoned, if excessive waste is to be avoided. The most advanced thought of the industry even holds that curtailment is with us to remain, not as ruthless proration of production, but as sane development of proven, though unexploited, structures where reserves, built up in scientifically worked out unit operations in reservoirs of nature's own making, are held as warranty of national safety and the continued industrial prosperity of our country. Conservation of this character is not only soundly profitable, but unit operation is the fundamental panacea to effect automatically a cessation of the wild scramble for oil and criminal squandering of a great national resource caused by unrestrained drilling.

A point too little stressed in any discussion of unit operation is its fundamental simplicity. Perhaps the ominous sound of the word "unitization" has obscured the underlying principles involved. As a matter of fact, unit operation is simply a multiple partnership—and a partnership is the most elemental of economic relations. There is no principle involved in unit operation that is not usual to a normal partnership in a lease development program. There is no single particular of unit operation, as practiced, that transcends any of the ample legal sanctions of common law, or statutory law both State and Federal, as applied to partnerships. There are no prerogatives granted in unit operation contracts, as currently used, that are not customarily ceded as between partners in lease operations. There are no terms in any of the approved forms of unitization contracts that legally contradict the lease terms of forms in generally accepted use. Unit operation, in actual practice, can, and does, carry out all the practices of ordinary partnership operations to safeguard all the rights reserved between co-partners as well as those rights reserved under the normal lease to the lessors and royalty owners.

*Presented at Eleventh Annual Meeting, American Petroleum Institute, at Chicago, Ill., November 12, 1930.

Types of Operation

For purposes of analysis, unit operation may be grouped into three types. There is the example of where a single individual or company acquires a block of leases and then parcels out fractional undivided interests in the entire area and in the well drilled. The second type is the instance of a group of leases held in severalty ownership where, by mutual exchange of fractional assignments, each operator acquires an undivided interest in each of the leases of the group in proportion to the size his lease bears to the total area of the group to be pooled. Third, there is the unit plan which contemplates merging the severalty ownership of producing and semiproven leases into a common ownership of undivided interests of the area grouped.

A consideration of types of unit operation must also comprehend an understanding of types of leases. Leases divide into two major types: Governmental and commercial. Since our consideration here does not extend to foreign operations, "governmental," as we use the term, includes leases granted and approved by the Federal Government, the state governments, state institutions, and county and municipal agencies. The terms of such leases are largely dictated by statutory enactments. Compared to this group are the "commercial leases," the terms of which are in the nature of private contracts. However, oil field leasing practice is so standardized that the enabling acts of government in setting up the types of leases granted on public lands have, broadly speaking, followed the conditions and general terms of the most approved forms of commercial leases. As a result, both types of leases, from the standpoint of the obligations contained in the terms are suitable for grouping into unit operations. Until recently many concerns hesitated, from a legal viewpoint, to submit to unit operation leases acquired from the Government. However, the broad endorsement of theory and practice of unit operation by the Federal Oil Conservation Board and the recent enactment by the Senate of the United States of a bill specifically to sanction co-operative development have largely removed these hesitancies to approve unit operation.

Stages of Progress

For any economic doctrine to achieve success in general application of its principles to practice, there are several stages of progress. Its financial success must be demonstrated; it must have sound legal endorsement; its results must be widely advertised; and last, but not least, it must be given popular appeal. As to the first, it is unnecessary to detail the numerous examples of unit operation the results of which, needless to say, have amply proved the claims made that the community of interest itself automatically regulates the development and production activities into the most soundly economic methods, which show increased profits from the very beginning of operations. With specific sanction of the Government, the legality of unit operation is no longer hazarded. With the plan endorsed by the American Petroleum Institute, advertised in a descriptive book prepared by the Mid-Continent Oil & Gas Association, and its individual success widely discussed in the various trade journals, there remains the one important duty of its sponsors, and that is to popularize it to where it becomes the method in demand for conducting exploration for, and exploitation, of new oil fields.

The encouragement of unit operation will of necessity consist of continued study and the advertising of its results; but it can be more directly fostered by a consistent discouragement of land practice alternatives. Until two years ago, it was common practice of promotion enterprises to finance themselves by the selling of "spreads" around a well to be drilled. This practice has already been largely discontinued in favor of unitizing blocks and selling undivided interests on a unit basis. But a more direct emphasis should be placed on discouraging selling of spread acreage or acreage sold subject to a well; and, automatically, unit operation is encouraged as the only available alternative. Dry hole contributions and acreage donations have promoted the wells that have opened up more than one-half of our pools to unrestrained drilling. Absolute elimination of dry hole contributions, or acreage contributions, as a practice of the industry will leave unit operation the only practical alternative on which costs of expensive testing can be shared.

Contract Forms

While these negative influences will have considerable effect, there are certain very positive steps that must be taken by the industry to encourage the practice. As already stated, unit operation is simply a partnership, and in any given case it is just that; but the complicating factor is that there are many kinds of partnership. There are probably no two concerns whose partnership contracts do not differ in minor ways. Essentially they both have fair contracts, and in actual application there would likely be very little difference; but both, through long practical usage, have come to prefer their own personal contracts. The essential need in encouragement of unit operation is for contracts that are universally accepted. Land departments need standard, endorsed, and approved forms of contracts. Those who have worked on committees on standardization of oil field equipment will recall the problems with which they were confronted, and the land departments of companies are confronted with the same type of problem in the miscellany of individual unit operation contracts which make of each transaction a separate problem of persuasion. While recognizing each individual concern's preferences in simple partnership, just as each individual company prefers its own lease forms, the need is for forms of contracts for unit operation as generally accepted in the "Producers 88" lease form, so that a common meeting ground for concerns to conduct negotiations for unit operation will be had.

The American Petroleum Institute could do no greater direct service to encourage unit operation than to formulate and secure endorsement from its members of standard forms of unit operation contracts and to have them printed and issued under the institute hallmark.

Standard Accounting

These comments on contract forms naturally include as part of these contracts a standard schedule of accounting. While no two companies will have absolutely identical systems, the principles of accounting are universal, and a standard schedule should be also adopted under which the unit operations of the future can be administered on a uniform basis.

It would be very unjust at this juncture not to recognize the splendid efforts of the committee of the Mid-Continent Oil & Gas Association to suggest unit operation contracts and an accounting schedule in their handbook on "Unitization of Oil Pools." It has been widely distributed, and already has done a great deal to explain and popularize unit operation. These contracts and accounting schedules, however, were written as suggestions, and have, therefore, not solved the problem for the land man, as the modifications each company insists on in practice are such that agreement is still a matter of individual persuasion. To popularize unit operation, it is essential that the mechanics of its functioning be simplified to where it compares favorably with a lease purchase, drilling contract, or purchase of a spread. The only way this can be approximated is by adoption of standard practice. The quibbles of legal phraseology and technicalities of preferential accounting must be overridden by the broader vision of executives in a direct sanction of certain approved forms sponsored by the institute. Unit operation must be grounded on foundations that will change it from an expedient to the accepted mode to insure its largest success.

Controversial Questions

There are only two or three really controversial questions with regard to unit operation on which there is a principle of importance at stake. One on which there is sincere difference of views is: "Should leases once pooled, on completion of the well as a failure, remain as partnership leases; or should they, by re-exchange of assignments, revert to severalty ownership." One side maintains that the operation for which the grouping was formed, being completed and abnadoned, the purpose of the unit has been served, and each thereafter should be vested with its severalty ownership to continue as it may judge expedient.

In contrast, the other side holds that each well so drilled, even if a dry hole, may develop information of such a defi-

(Continued on Page 259)

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Proper Selection of Oil Well Casing

Design of Casing Programs of Great Importance. Safety Factor Practices in Tensile Stress of Joints

By J. R. Gignoux
Shell Oil Co., Los Angeles, Calif.*

ABSTRACT

The design of casing programs is of great importance to the operator because of the cost of this commodity, which is between 23 to 35 per cent of the entire initial cost of a well. Furthermore, unfavorable selection of sizes or inadequate technique in setting casing can further increase the cost by the requirement of additional strings. The results of a study of casing practices, conducted by the A.P.I. California District Drilling Practice Committee from data on over 200 wells are shown. From this study a new clearance ratio method of proportioning sizes for casing programs is advanced. Examples of several typical casing programs are shown in which all are largely derived by the clearance ratio method.

Programs requiring underreaming are compared with those in which the practice is eliminated. Although underreaming may reduce the cost of a well, this advantage is offset by many undesirable features which are difficult to evaluate. The safety factor practices in tensile stress of casing joints and collapsing stress of casing are shown. Though these appear to be justified by common usage, there are many indeterminable factors entering into the problem tending to make it advisable to increase the wall thickness of the selected casing to the utmost limit consistent with a reasonably economical policy.

The importance of the highest degree of drilling technique in the conditioning of holes before running casing is stressed. Clearance ratios well established by use will not apply in cases where the drilling muds are not of good quality or the reaming and/or underreaming operations are not thoroughly carried out.

Little may be done toward increasing or decreasing the present A.P.I. casing lists until the operators establish by use the most desirable sizes and weights to fit an almost unlimited number of formation conditions or friction depths occurring in the now existent or future fields. However, a uniform method of designing programs in a field will tend toward uniformity in sizes and weights in that particular field. Thus decreased casing stocks will be possible with a corresponding decrease in casing costs as a whole.

The selection of casing is an item of major importance in the development of oil wells because the sizes, weights, setting points, and combinations of casing strings are factors affecting the success of a well from its inception to the depletion of the oil zones. This, unlike any other item of well equipment, can rarely be changed. Hence, with the selection once made and the casing set, there is little that may be done in later periods toward beneficial alterations or substitutions. The importance of the selection in a measure may also be based on the cost of the casing used, which is between 23 and 35 per cent of the entire initial investment in a well, depending on the number of strings required by the formation conditions and the policy in selecting sizes. Thus it may be seen, both from a monetary consideration and a viewpoint of good practice, that careful study and consideration of casing programs are highly advisable and warranted.

The success of any casing practice depends largely on the ability to land the proper sized strings at the desired depths. A failure in this accomplishment will result in considerable loss because of the resulting difficult water shutoffs or, as frequently occurs, because an entirely new casing string, not contemplated originally, will be required. The latter case has a twofold disadvantage: First, in that the cost of the well is increased by the value of the casing; and, second, the diameter of all strings subsequently set must be reduced, which generally results in so small a final oil string that future production operations are penalized.

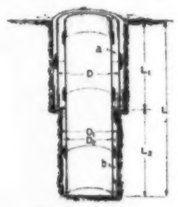
FRICTION FORMULA
IN WHICH
D = INSIDE DIAMETER OF PIPE
D1 = DIAMETER OF OPEN HOLE
D2 = OUTSIDE DIAMETER OF PIPE COUPLINGS
f = COEFFICIENT OF FRICTION PIPE SURFACE TO PIPE SURFACE
f1 = COEFFICIENT OF FRICTION PIPE SURFACE TO FORMATION SURFACE
W = COMPLETE WEIGHT PER FOOT OF PIPE
L = LENGTH OF CASING STRING

Figure 1—Diagram illustrating theoretical casing friction.

Theory of Forces in Setting Casing

From a purely theoretical viewpoint, the principles involved in running casing may be compared to friction between two surfaces where the force required to move the pipe is the product of the surface area, or area in contact, and a coefficient of friction. This is illustrated in Figure 1, and the relation of the factors in the problem is shown by:

$$WL = D\pi fL_1 + D_1\pi f_1 L_2$$

$$WL = \pi(DfL_1 + D_1 f_1 L_2)$$

The value of the coefficients of friction f and f_1 has a relation to the clearances a (between the pipe surfaces) and b (between the pipe surface and formation surface) respectively. Larger clearances undoubtedly result in decreased coefficients, but the relationship of clearance to coefficients of friction has not been developed to permit its advancement at this time. It is even possible that no usable relationship will ever be found between the theory and actual practice because of the many indeterminable factors entering into the problem as:

(a) Lack of homogeneity of mud fluids surrounding the casing.

(b) Effect of the projection of casing couplings.

(c) Effect of the formation portion of the hole to be cased.

(d) Vertical deviations of the hole.

(e) Nonuniform section of the hole.

Such a number of largely indeterminable factors rather precludes the possibility of a determination of casing clearances on a purely theoretical basis, but the theory does furnish the background for empirical determinations of clearances for use in good practice.

Problem

There has been much discussion of casing programs and practices; and, as this represented a field for useful study, the subject was assigned to the California District Drilling Practice Committee, which obtained data on about 225 wells in seven major and now active drilling fields in California (subsequently designated as fields 1 to 7 inclusive).[1] These fields are representative of both shallow and deep operations now being carried out in California, and are believed to be quite comparable to similar operations in many other districts and areas. The committee has also considered the possibility of a reduction in, or additions to, the sizes and weights of casing now on the A.P.I. standard lists[2] with the idea of possibly improving practices by suggesting sizes and weights which may better fit into programs for various operations.

Casing Clearances Used in Practice

Since a theoretical analysis seemed to have its limitations, the problem was approached from an empirical consideration. This involves many terms used in practice which are explained in the following definitions:

Flush Joint Casing: Casing connected by flush joints fabricated within the walls of the pipe and having no projecting couplings.

Slip Joint Casing: Casing having an expanded bell end into which the pipe end is inserted and the connection made by subsequent welding.

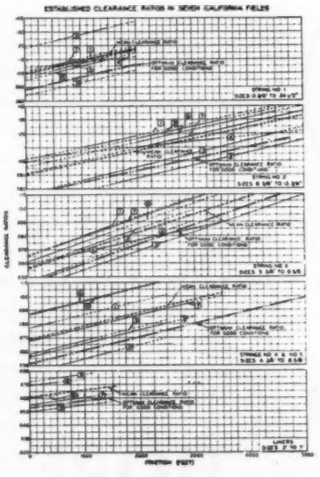

Figure 2.

Stovepipe Casing: Pipe of two-ply material in sections with the field connections made by inserting the inner ply in the outer and subsequent welding.

Casing, Casing String, or String: The connected length of casing extending into the well. This may be either the same size and type throughout its entire length, or it may be of different types with sizes very close to the same diameters, in the latter case called a mixed string.

Pipe Clearance: The space between the inside of a casing string and the outside diameter of the pipe couplings of a casing string contained within it or half the difference between the two diameters.

Open Hole or Friction: Any portion of the drilled hole within which casing is to be placed.

Hole Clearance: The space between the diameter of the drilled hole and the outside diameter of the pipe couplings—this being half the difference between the diameter of the open hole and the outside diameter of the couplings on the casing set or to be set in the hole. In the case of flush joint or stovepipe casing, the outside diameter of the casing is considered, and with slip joint casing the outside diameter of the bell end is used in determining clearance ratios.

Liner: The portion of casing below the bottom of the previous string and lapping into it but not extending to the surface.

Reaming: The operation of enlarging the open hole to full diameter, or the full size, of the drilling bits.

Underreaming: The operation of increasing the diameter of the open hole in excess of the full size of the drilling bit. This operation can only be carried out by means of special drilling tools, as the size of the final hole is in excess of the inside diameter of the previous string set.

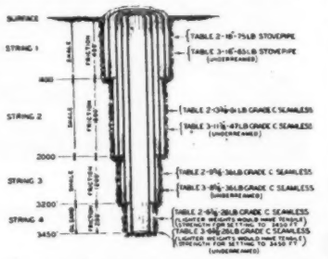

Figure 3—Casing program for a shallow field.

Setting Depth or Depth: Depth to which casing is set.

Oil String: The casing string extending into the oil sands and set for the purpose of obtaining production.

Water String: The casing string set above the oil-bearing formations for the purpose of excluding water. There may be several water strings.

Surface Strings: The first string of casing set. This may also be a water string.

Clearance Ratio: The relationship between the hole clearance and the diameter of the open hole expressed as a ratio. This is represented by the symbols in Figure 1 as:

$$\frac{D_1 - D_2}{2D_1}$$

Freezing of Casing: The occurrence, upon running casing into the open hole, of it becoming stuck at a point above the desired setting depth.

Fishing: The operations in recovering tools, drill pipe, casing, or tubing from the hole.

The clearance ratios for all strings of casing upon which records were obtained have been calculated, and the open hole, or friction, in which they were set has been determined. The averages of these clearance ratios are plotted against the friction for the various groups of casing sizes in the seven fields under considera-

*Paper presented at eleventh annual meeting, American Petroleum Institute, at Chicago, Ill., November 12, 1930.

[1]Key to field numbers: 1 Elwood Goleta. 2 Kettleman Hills. 3 Long Beach. 4 Maricopa Flats. 5 Santa Fe Springs. 6 Seal Beach. 7 Ventura.

[2]A.P.I. standards 5-A, pipe specifications, 6th edn., Jan., 1930, pp. 19 to 24, and 53.

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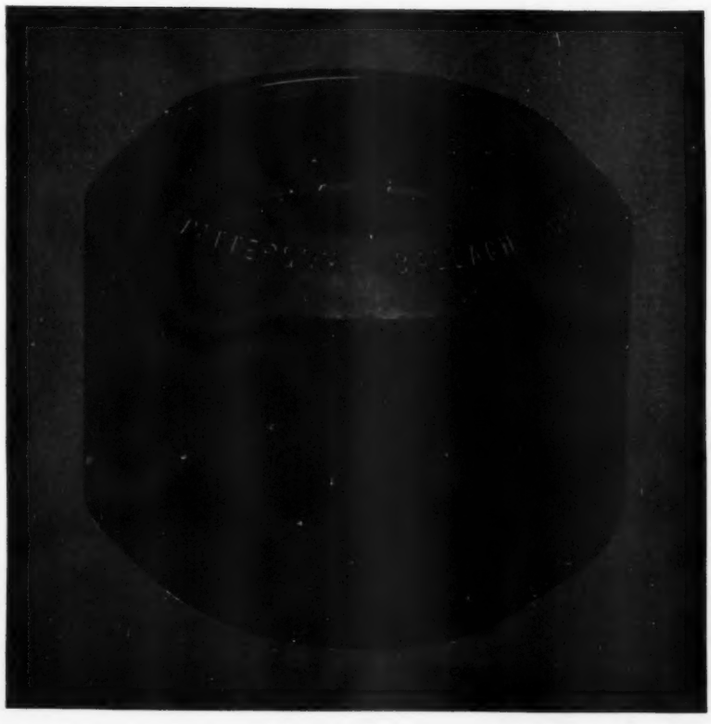

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tion, as shown in Figure 2. The maximum and minimum averages are shown by the upper and lower limiting lines, respectively, with numerous instances of intermediate clearance ratios. It will be noted that the clearance ratios are greater for the various groups of casing in the larger sizes, and that all ratios increase with greater friction depths. This also indicates an increase in hole clearance for larger casing sizes and increased friction lengths, which is quite in conformity with the theory involved. The relationship between the various groups of casing sizes and the maximum and minimum of the average clearance ratios for average friction lengths is shown in Table 1.

Application of Clearance Ratios

Possible casing programs have been devised for an assumed shallow, moderately deep, and a deep field as shown in Figures 3, 4, and 5, respectively. These programs are all determined by the use of

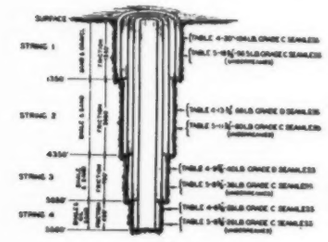


FIG. 4

Casing program for a moderately deep field.

clearance ratios within the maximum and minimum, and are indicated as the "optimum clearance ratio for good conditions," in Figure 2. The optimum clearance ratio is arbitrarily assumed as being slightly greater than the minimum in order to have a margin of safety, but it is not necessarily recommended that any operator adopt it as the best practice for his particular conditions. This is explained by the fact that the minimum shown is an average minimum, and casing strings have been set with even lower clearance ratios than shown; hence similar practices may again be carried out under favorable conditions. It is believed, however, that clearance ratios approximating the minimums are good practice, because experience indicates that casing may be successfully run with these ratios. By this means the sizes of the various casing strings will be kept at a minimum, with a similar reduction in well costs.

The effect of formations in the selection of the most desirable clearance ratios is a matter of some conjecture. There

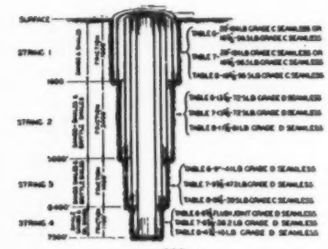


FIG. 5

Casing program for a deep field.

are numerous examples in the use of the same casing programs in several fields in widely separated localities where the formation characteristics must vary considerably. This indicates that too much weight has been given to a thought that formations in general are a factor of grave importance. However, it is believed that drilling technique, which is considered later, is at least equally important.

In designing casing programs, the operators must assume the number of casing strings to be used and the depths at which they are to be set in case the data has not been developed by previous operations. It is also necessary to decide upon the size of the final oil string, which good practice now indicates to be not less than 5¼ or 6⅝ inches. To demonstrate the method of using clearance ratios, assume the conditions as set forth in Figure 3 with the use of four casing strings. Referring to Table 2, a calculated diameter of the open hole of 8.3 inches is derived by first obtaining a clearance ratio of 0.055 from Figure 2 for 400 feet of friction in the fourth string and solving for the open hole diameter. The quantity D_2 represents the outside diameter of the coupling on the string to be set, which in this case is 7.39 inches for 6⅝-inch casing. The detail of the calculation follows:

$$\frac{D_1 - D_2}{2D_1} = 0.055$$

$$\frac{D_1 - 7.39 \text{ in.}}{2D_1} = 0.055$$

$$D_1 = 8.3 \text{ in.}$$

The next step is to determine the size of the third or water string. This must have an inside diameter sufficient to allow the passage of a bit which will make a hole about 8.3 inches in diameter, either equal to or slightly greater than the calculated open hole diameter. The nearest A.P.I. standard casing to meet this requirement is 9⅝-inch, 36-pound, with an inside diameter of 8.921 inches. This casing in A.P.I. Grade C materials may be set to a depth of 6,079 feet[3] in tension with a safety factor of 2½; therefore, it will readily meet the depth condition of 3,200 feet. Also, it will have a safety factor of 1.5 inches collapse[3], which is indicated as now acceptable practice in the graph shown in Figure 6, and further explained in a later discussion of the selection of casing from the viewpoint of stresses imposed. A similar method of calculating is used for the remaining strings in Table 2 and for the complete casing programs shown in Tables 3, 4, 5, 6, 7, and 8. A clearance for running the bit within the casing must be allowed, and in usual practice this is 0.25 inch, because the drift tests on casing allow minus variations in in-

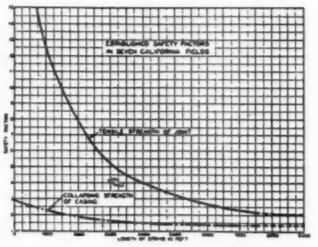


Figure 6.

side diameter of one-eighth to three-sixteenth-inch[4]. The nearest practical bit size would be 8⅝-inch after deducting 0.25 inch from the inside diameter of the casing for the bit clearance.

The use of flush joint casing in open hole is practiced to a considerable extent, and there is some question as to the advisability of providing slightly greater clearance ratios for this type of pipe. In determining clearance ratios, it has been explained that the outside diameter of the coupling is used in the case of ordinary casing, whereas the outside diameter of the pipe is used with the flush joint construction. Assuming that the outside diameter of the collars and the outside diameter of a slightly larger flush joint pipe are the same, it would be logical to allow a slightly increased clearance ratio for the flush joint if it is set at the same depth in friction. The effect of the couplings scraping the wall of the hole while the pipe is being run, and their limited length in contact, appears to be a favorable factor in setting casing. At the same time, flush joint casing does not aid in keeping the walls of the hole clear; and, furthermore, its entire length has greater opportunity to be in contact with the wall of the hole, thus permitting greater friction area.

Underreaming

Two examples of casing programs in which underreaming has been practiced are shown in Tables 3 and 5. These tables cover the conditions set forth in Figures 2 and 4, respectively, and may be compared with programs where underreaming is eliminated, as shown in Tables 2 and 4. California operators are not in

TABLE 1

String No.	Sizes of casing in various groups—	Average clearance ratio: Minimum	Average clearance ratio: Maximum
1	24-in. to 13⅜-in. lapweld, stovepipe, and seamless casing with couplings or welded insert or slip joints	0.093	0.128
2	13⅜-in. to 8⅝-in. lapweld or seamless casing with couplings	0.094	0.125
3	9⅝-in. to 5⅝-in. lapweld or seamless casing with couplings or flush joints	0.062	0.087
4 and 5	8⅝-in. to 4½-in. seamless casing with couplings or flush joints	0.053	0.095
Liners	3-in. to 7-in. seamless casing or tubing with couplings or flush joints	0.053	0.076

TABLE 2—DETAIL OF CASING PROGRAM FOR A SHALLOW FIELD ILLUSTRATED IN FIGURE 3 (NOT UNDERREAMED)

String No.	O.D. csg. (in.)	Wt. (lbs. per ft.)	I.D. csg. (in.)	O.D. coupling (in.)	Type and grade of casing	Clearance ratio	Calculated diam. of hole (in.)	Actual diam. of hole (in.)	Depth set (ft.)	Safety Factor: Tension	Safety Factor: Collapse
4	6.625	26	5.855	7.390	Seamless C	0.055	8.30	8.625	3,450	*4.6	*2.9
3	9.625	36	8.921	10.625	Seamless C	0.063	12.16	12.250	3,200	*4.7	*1.5
2	13.375	61	12.515	14.375	Seamless C	0.090	17.53	17.500	2,000	*7.6	*1.9
1	....	75	†18.000	†19.125	Stovepipe	0.092	23.44	25.000	400	...	...

Remarks—Assume 6⅝-inch casing proper size for oil string. Lightest weight 9⅝-inch casing. *Setting depths from A.P.I. pipe code No. 5, 1st edn., July, 1929. †Based on use of stovepipe casing. If lapweld or seamless is used, figures will not apply.

TABLE 3—DETAIL OF CASING PROGRAM FOR A SHALLOW FIELD ILLUSTRATED IN FIGURE 3 (UNDERREAMED)

String No.	O.D. csg. (in.)	Wt. (lbs. per ft.)	I.D. csg. (in.)	O.D. coupling (in.)	Type and grade of casing	Clearance ratio	Calculated diam. of hole (in.)	Actual diam. of hole drilled (in.)	Actual diam. of hole U.R. (in.)	Depth set (ft.)	Safety Factor: Tension	Safety Factor: Collapse
4	6.625	26	5.855	7.390	Seamless C	0.055	8.30	7.500	8.25	3,450	*4.6	*2.9
3	8.625	36	7.825	9.593	Seamless C	0.063	10.95	10.750	11.25	3,200	*5.0	*2.3
2	11.750	47	11.000	12.866	Seamless C	0.090	15.65	15.375	....	2,000	*7.3	*1.9
1	....	65	†16.125	†17.500	Stovepipe	0.092	21.40	21.000	....	400	...	...

Remarks—Assume 6⅝-inch casing proper size for oil string. Lightest weight 11⅝-inch casing. *Setting depth data obtained from A.P.I. pipe code No. 5, 1st edn., July, 1929. †Based on the use of stovepipe casing. If lapweld or seamless is used, figures will not apply.

TABLE 4—DETAIL OF CASING PROGRAM FOR A MODERATELY DEEP FIELD ILLUSTRATED IN FIGURE 4 (NOT UNDERREAMED)

String No.	O.D. csg. (in.)	Wt. (lbs. per ft.)	I.D. csg. (in.)	O.D. coupling (in.)	Type and grade of casing	Clearance ratio	Calculated diam. of hole (in.)	Actual diam. of hole (in.)	Depth set (ft.)	Safety Factor: Tension	Safety Factor: Collapse
4	6.625	26	5.855	7.390	Seamless C	0.056	8.32	8.500	5,500	*2.9	*1.8
3	9.625	40	8.835	10.625	Seamless D	0.055	11.94	12.125	5,050	†3.7	†1.5
2	13.375	68	12.415	14.375	Seamless D	0.102	18.08	18.750	4,350	†4.6	†1.4
1	‡20.000	104	19.036	21.000	Seamless C	0.100	24.25	27.000	1,350	...	...

Remarks—Assume 6⅝-inch casing proper size for oil string. Lightest weight 9⅝-inch casing. Slip joint. *Setting depths from A.P.I. pipe code No. 5, 1st edn., July, 1929. †Setting depth from National Tube Co. specifications. ‡18⅝-inch could be used in practice, but with a sacrifice in clearance.

TABLE 5—DETAIL OF CASING PROGRAM FOR A MODERATELY DEEP FIELD ILLUSTRATED IN FIGURE 4 (UNDERREAMED)

String No.	O.D. csg. (in.)	Wt. (lbs. per ft.)	I.D. csg. (in.)	O.D. coupling (in.)	Type and grade of casing	Clearance ratio	Calculated diam. of hole (in.)	Actual diam. of hole drilled (in.)	Actual diam. of hole U.R. (in.)	Depth set (ft.)	Factor Safety: Tension	Factor Safety: Collapse
4	6.625	26.0	5.855	7.390	Seamless C	0.056	8.32	7.500	8.250	5,500	*2.9	*1.8
3	8.625	36.0	7.825	9.593	Seamless C	0.055	10.75	10.500	11.000	5,050	*3.1	*1.4
2	11.750	60.0	10.772	12.866	Seamless C	0.102	16.10	17.375	....	4,350	*3.4	*1.4
1	18.625	96.5	17.655	19.750	Seamless C	0.100	24.65	25.000	....	1,350	†11.8	†1.8

Remarks—Assume 6⅝-inch casing proper size for oil string. *Setting depth from A.P.I. pipe code No. 5, 1st edn., July, 1929. †Setting depth from National Tube Co. specifications.

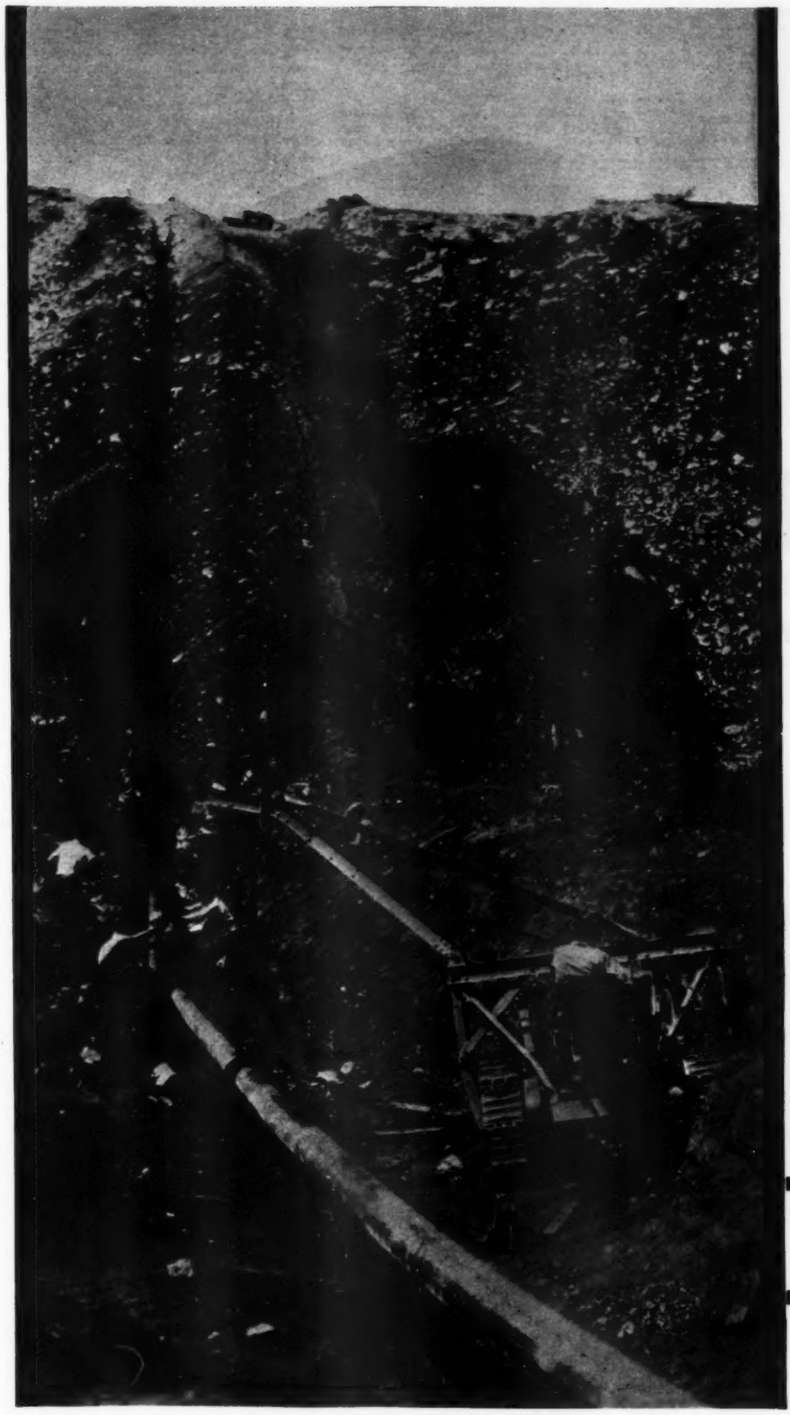
TABLE 6—DETAIL OF CASING PROGRAM FOR A DEEP FIELD AS ILLUSTRATED IN FIGURE 5 WITH 6⅝-INCH FLUSH JOINT CASING IN FRICTION IN STRING 4 (NOT UNDERREAMED)

String No.	O.D. csg. (in.)	Wt. (lbs. per ft.)	I.D. csg. (in.)	O.D. coupling (in.)	Type and grade of casing	Clearance ratio	Calculated diam. of hole (in.)	Actual diam. of hole (in.)	Depth set (ft.)	Safety Factor: Tension	Safety Factor: Collapse
4	†6.625	26.2	5.855	.....	Seamless D	0.062	7.56	7.875	7,500	*2.7	*1.7
3	9.000	41.0	8.150	10.250	Seamless D	0.065	11.78	12.000	6,400	*3.0	*1.5
2	13.375	72.5	12.347	14.375	Seamless D	0.105	18.20	18.750	5,000	*3.8	*1.4
1	20.000	104.0	19.036	21.000	Seamless C	0.103	26.45	27.000	1,600	...	...

Remarks—Assume 6⅝-inch flush joint in friction. Collared pipe above for oil string. Slip joint. *Setting depth from National Tube Co. specifications. †5⅝-inch seamless Grade D casing with collars capable of being set at 7,772 feet could be substituted for the 6⅝-inch in String No. 4, as the outside diameter of the couplings on the 5⅝-inch size is 6.65 inches as compared to 6.625 inches outside diameter for the flush joint.

[3] A.P.I. pipe code No. 5—Care and Use of Oil Country Tubular Goods, 1st edn., July, 1929, p. 39.

[4] A.P.I. standards No. 5-A—Pipe Specifications, 6th edn., Jan., 1930—Drift Tests, p. 10.



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accord with the advisability of underreaming practice, though all agree that it increases the drilling time of a well and decreases the cost of casing. A summary of the casing operations of about 200 wells in seven California fields is shown in Table 9. This represents the practice of numerous operators, and the prevalence in the practice of underreaming will be noted in field No. 1 which has an average well depth of 3,450 feet, whereas in field No. 2 very little underreaming is done in wells having an average depth of about 7,000 feet. This, in a measure, indicates the possible advantages in shallow territory and the disadvantages in the deeper fields.

The effect on the cost of a well is undoubtedly a very important factor in the selection of a casing program, which may or may not require the practice of underreaming. In this connection, Table 10 has been prepared which brings out a comparison of those portions of a well cost in which underreaming and casing costs are involved. These are based on the programs designed in Tables 2 and 4 (not underreamed) as compared to Tables 3 and 5 (underreamed); and it is apparent that underreaming practices would be the least expensive under both of these conditions.

The percentage of additional drilling time consumed in underreaming is largely a matter of technique of the individual operator. It can readily be seen that the time will bear a direct relation to the thoroughness of the underreaming operation. That there is a large variation in the additional time for underreaming operations is evidenced by a range of from 2 to 10 per cent as shown in Table 9.

There are two distinct disadvantages in underreaming practices that are outstanding. First, it increases drilling time and thereby penalizes the obtaining of early production, which in the past has been a matter of grave importance to the operator in competitive territory. Second, it adds an operation and requires the use of a drilling tool which can fail to function and possibly cause a serious "fishing" job. A decision on an underreamed program cannot be treated as a general case, but must largely rest on the individual operator. In making a decision, the decreased cost of casing can be weighed against the disadvantages of cost of increased drilling time, loss of production in competitive areas, and the hazards in the use of the required underreaming tools. However, there is a point which cannot be ignored, in that the practice of underreaming so prevalent some years ago is rapidly decreasing, and it is rarely resorted to in the recent deep fields except as an emergency in the event casing freezes and extraordinary means must be taken to set it at the desired depth.

An interesting argument has been advanced by an operator for underreaming in the oil zones to remove the drilling muds from the walls of the hole in fields where the static head of the fluid is low. It is contended that the normal mudding of the wall of the hole during drilling will prevent the production from freely entering the hole; whereas if the pressures are high, the fluid will remove the mud barrier without the necessity of cleaning the wall. Therefore, the hole is reamed to remove the mud, and not necessarily as an aid in setting casing. The value of the operation is largely a matter of production technique, and not a vital question in the casing problem.

Stresses Imposed

There is a wealth of published data on the length of casing string equivalent to the strength of the joint, and the length of string equivalent to the collapsing strength of the casing, some of which is in a very convenient graphical form[5]. However, it is not the practice to select a casing with the exact wall thicknesses or weight to resist the theoretical collapsing and pullout loads, but to provide the greatest safety factor within the limits of economical considerations. This is logical factors in the stresses to which casing will be subjected. A recent A.P.I. paper on casing[4] states:

"The actual stresses to which casing is subjected in oil field practice is difficult, if not impossible, to evaluate. Many types of loading are possible, some of which produce stresses that are easily determined. In most cases the actual stress is a combined stress resulting from a number of co-acting forces, some of known value and others that can only be studied qualitatively—or approximated at the best.

"Drilling to lower zones makes the question of casing stress of great importance. Present programs require the use of heavier and stronger material; and even with these materials, the question arises as to what maximum conditions can be met and what factors of safety exist."

There are other factors entering into the selection of wall thickness and weight of casing which are of equal importance to the stress consideration, viz., the wear in the casing from drilling operations and the future effects of corrosion. Little is known of casing wear unless the wall is completely worn through, but there are many examples of casing failure supposedly from corrosion. A California field has been subjected to such failures in 10 years after the completion of the well; whereas, by providing a heavier casing, it would have continued serviceable, possibly, to the time of the depletion of the oil zones. A combination of corrosion deterioration and increased collapsing stress, due to decreases in the fluid levels with the depletion of the oil zones, is also a factor well worthy of thought.

A compilation of the casing data from numerous wells in California fields, as shown in Table 11, indicates the use of safety factors in the tensile strength of the joint for the actual depth of casing set. It also shows the safety factors against collapse to be much lower than those of the tensile strength of joints for similar lengths of strings. The relation of the safety factors now in general use to the length of the strings is graphically shown in Figure 6, and the allowable safety factors against collapsing stresses were obtained from this graph for the theoretical strings shown in Tables 2 to 8, inclusive.

Although these figures establish the safety factors now used in practice, it seems logical to maintain the factors at the highest possible figure because of the indeterminable factors with a bearing on the problem which are summarized as follows:

(a) Collapse, bending, shearing, and crushing stresses.

(b) Corrosion deterioration.

(c) Future increases in collapsing stresses.

(d) Wear on casing due to drilling and producing operations.

Little may be done at the present time other than accepting safety factors comparable with those now in general use because of the financial consideration involved in the use of heavier casing to meet the indeterminable conditions. The scope of this paper does not permit a study of this phase of the problem, but the data on the commonly used safety factors do bring out that these, in collapse, are, in general, dangerously low. This is quite apparent when we make comparisons with the safety factors in common use in other branches of engineering. Good practice indicates the desirability of increases, notwithstanding that any decided improvement will require either additional weights and possibly additional sizes or the adoption, to some extent, of casing of true alloy steels.

Conditioning of Hole

Although it is not the purpose of this paper to discuss drilling technique, the factor of hole conditioning cannot be ignored because of its importance in the successful setting of casing to the desired depths. The drilling muds should be circulated until largely free of sand, because no condition more conducive to a high friction coefficient can be imagined than to use mud laden with sand when it is assumed to function as a lubricant. The lubricating qualities of the muds may, in a measure, be increased by the admixture of materials of high colloidal properties, though the claimed advantages of the uses of such substances is not accepted by all operators.

Equally as conducive of failures to set casing is the lack of thoroughness in reaming or underreaming the hole. A projection or series of projections of the formations into the open hole, along with

(Continued on Page 166)

[4] C. J. Coberly, "Analysis of Casing Stresses and California Casing Practice," Am. Pet. Inst., D. & P. E. Bull. 204, Jan., 1930, p. 22.

[5] "Alloy Seamless Steel Casing with More Clearance Provides Greater Strength Than Other Steels," Oil Field Eng., March 1, 1930.

TABLE 7—DETAIL OF CASING PROGRAM FOR A DEEP FIELD AS ILLUSTRATED IN FIGURE 5 WITH 6⅝-INCH COUPLED PIPE IN ENTIRE OIL STRING (NOT UNDERREAMED)

String No.	O.D. csg. (in.)	Wt. (lbs. per ft.)	I.D. csg. (in.)	O.D. coupling (in.)	Type and grade of casing	Clearance ratio	Calculated diam. of hole (in.)	Actual diam. of hole (in.)	Depth set (ft.)	Safety Factor: Tension	Safety Factor: Collapse
4	6.625	26.2	5.855	7.390	Seamless D	0.062	8.44	8.500	7,500	*2.7	*1.7
3	9.625	47.2	8.681	10.625	Seamless D	0.065	12.21	12.125	6,400	*2.9	*1.6
2	13.375	72.5	12.347	14.375	Seamless D	0.105	18.20	18.750	5,000	*3.8	*1.4
1	20.000	104.0	19.036	21.000	Seamless C	0.103	26.45	27.000	1,600	...	...

Remarks—Assume 6⅝-inch collar pipe for oil string. Slip joint. *Setting depth from National Tube Co. specifications.

TABLE 8—DETAIL OF CASING PROGRAM FOR DEEP FIELD AS ILLUSTRATED IN FIGURE 5 WITH 4½-INCH OIL STRING (NOT UNDERREAMED)

String No.	O.D. csg. (in.)	Wt. (lbs. per ft.)	I.D. csg. (in.)	O.D. coupling (in.)	Type and grade of casing	Clearance ratio	Calculated diam. of hole (in.)	Actual diam. of hole (in.)	Depth set (ft.)	Safety Factor: Tension	Safety Factor: Collapse
4	4.750	16.0	4.082	5.364	Seamless D	0.062	6.12	6.375	7,500	*2.9	*2.2
3	8.125	39.5	7.185	9.094	Seamless C	0.065	10.45	10.500	6,400	†2.6	†1.6
2	11.750	61.0	10.772	12.866	Seamless D	0.105	16.28	17.500	5,000	*3.7	*1.5
1	18.625	96.5	17.655	19.750	Seamless C	0.103	24.87	25.000	1,600	†9.8	†1.5

Remarks—Assume 4½-inch casing proper size for oil string. *Setting depth from National Tube Co. specifications. †Setting depth from A.P.I. pipe code No. 5, 1st edn., July, 1929.

TABLE 9—SUMMARY OF PRACTICE WITH REFERENCE TO UNDERREAMING

Field No.	No. of wells reported on	No. of wells underreamed	Operators' opinions on desirability of underreaming: Affirmative	Operators' opinions on desirability of underreaming: Negative	Pct. increase in drilling time occasioned by underreaming	Average depth of wells (feet)
*1	18	13	4	0	8.3	3,480
†2	14	1	0	4	8.3	6,680
†3	72	12	1	3	6.0	6,891
†4	11	5	..	3	2.0	3,360
‡5	14	11	1	2	6.7	6,860
†6	25	18	1	1	10.0	5,512
†7	37	8	1	2	4.9	6,895

Causes for Underreaming When Practiced.—*Sloughing formations and combinations of casing, required underreaming. †Some casing combinations used required underreaming. ‡Allow larger sizes of casing for later deepening and combinations of casing; required underreaming.

TABLE 10—COMPARISON OF COST BETWEEN HOLES WITH AND WITHOUT UNDERREAMING

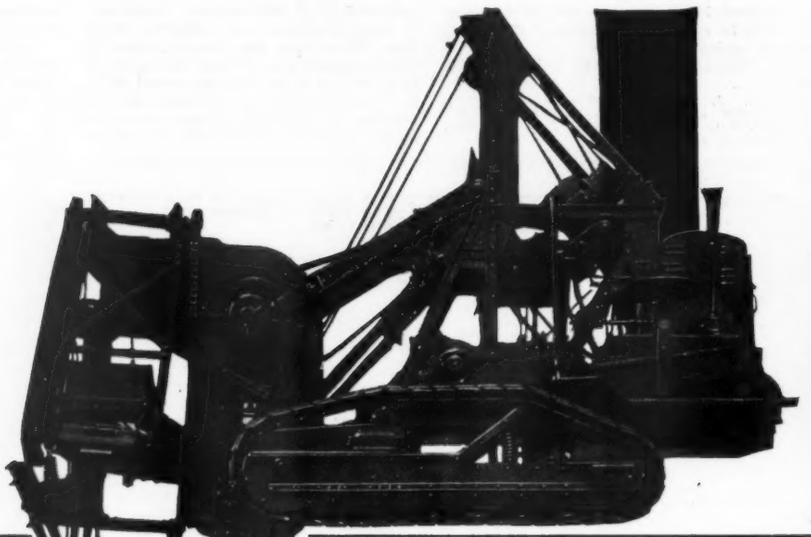
Type of well—	Figure No.	Table No.	Underreamed	Cost of casing	Increase in drilling time occasioned by underreaming (per cent)	Cost of underreaming	Combined cost of of casing and underreaming
Shallow	2	2	No	$20,264	....	....	$20,264
Shallow	2	3	Yes	17,767	8.3	1,850	19,617
Moderately deep	3	4	No	49,908	....	....	49,908
Moderately deep	3	5	Yes	41,236	10.0	4,320	45,556

TABLE 11—SUMMARY OF PRACTICE WITH REFERENCE TO COLLAPSE AND TENSILE SAFETY FACTORS

Field—	Total No. of wells considered	Average depth of wells (feet)	No. of strings*	No. of wells considered for various strings	Average setting depth for strings (feet)	Safety factor in tensile strength of joint in casing	Safety factor in collapsing strength of casing
1	17	3,480	1	5	456	2.2	2.5
			2	17	2,040	7.5	2.0
			3	17	3,180	4.8	2.1
			4	9	3,480	4.5	2.9
2	14	6,680	1	14	1,367	15.3	1.6
			3	14	5,135	3.7	1.4
			3	14	6,340	3.1	2.0
			4	2	7,375	2.8	2.1
3	70	6,891	1	8	863	13.3	3.8
			2	70	3,860	3.8	1.3
			3	70	5,580	2.8	1.5
			4	61	6,650	2.2	1.4
			5	5	6,845	1.9	1.8
4	11	3,360	1	6	367	....	3.1
			2	11	3,041	4.7	1.6
			3	6	3,174	4.3	2.2
			4	3	3,019	4.7	3.8
5	27	6,860	1	10	1,500	10.1	1.8
			2	27	4,125	4.15	1.4
			3	27	5,950	2.6	1.4
			4	22	6,500	2.5	1.6
			5	4	6,543	2.5	1.9
6	25	5,512	1	16	1,240	7.6	1.2
			2	25	4,250	3.5	1.5
			3	25	4,950	3.1	1.7
			4	24	5,460	2.9	2.0
7	37	6,895	1	4	734	13.6	2.4
			2	37	4,280	3.5	1.0
			3	37	5,750	2.8	1.3
			4	32	6,575	2.4	1.6
			5	6	6,780	2.4	1.9

*See Table 1 and Figure 2 for ranges of casing sizes embraced in the various strings as numbered.

N 9



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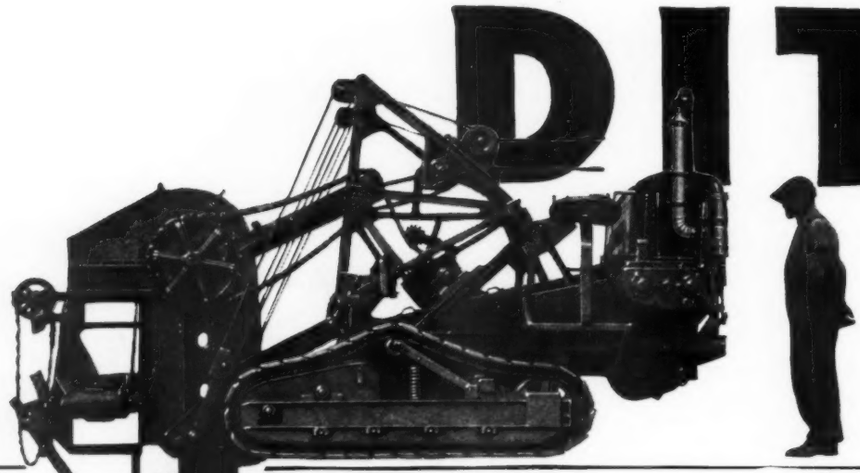

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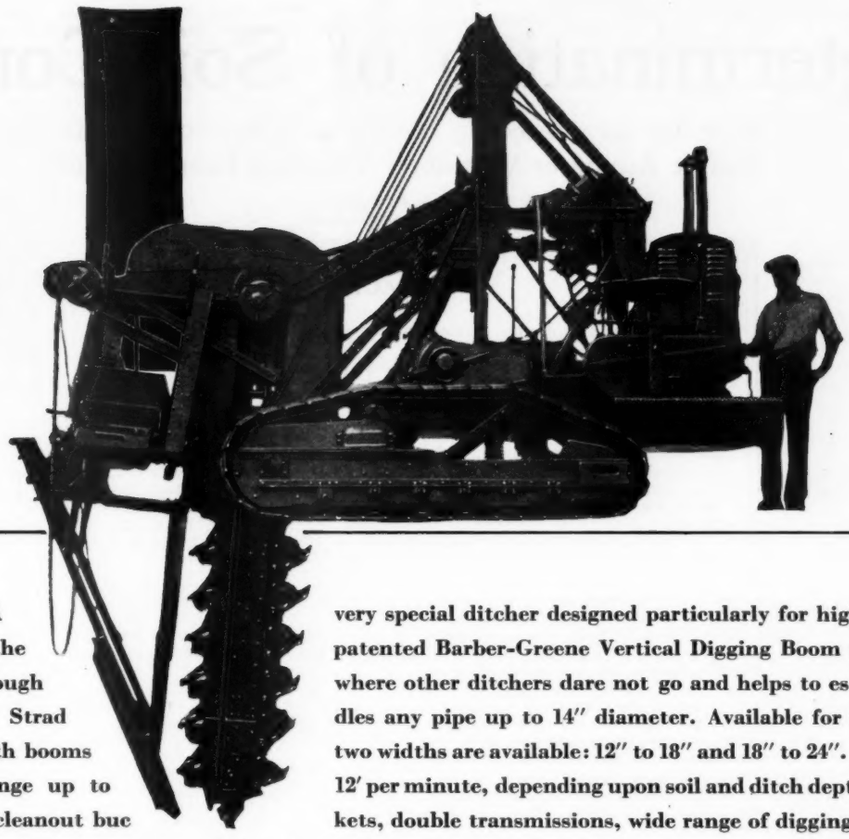

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Predetermination of Soil Corrosion

May Be Evaluated in Terms of Electrical Units. Simple Ammeter Voltmeter Test Has Been Devised

By Joseph F. Putnam
Standard Oil Co. of California*

ABSTRACT

Soil corrosion, being an electrolytic phenomenon, may be evaluated in terms of electrical units.

A simple ammeter voltmeter test has been devised which may be used to predetermine the corrosivity of soil in which iron is buried. More work is necessary in order to correlate moisture content with soil textures and rainfall.

In general, the method gives a rather close correlation to the corrosion experience on buried pipe lines, except in extreme cases where the electrical resistance of the oil is very low and steady long line currents of considerable magnitude may be set up which materially affect corrosion. By long currents is meant currents of electricity which flow for several feet before leaking off into the soil.

To date no method has been devised to predetermine those long line currents either in direction or amount.

It has been estimated that at least 60 per cent of the iron and steel produced in the United States goes to replace losses caused by corrosion. Up to the time of the present large natural gas development in the Mid-Continent and on the Pacific Coast, it is probable that an even larger percentage of pipe was used to replace that made unfit for service by corrosion. Taken by and large, the greatest maintenance problem the engineer has to face is corrosion prevention, mitigation and replacement. Soil corrosion of buried structures, such as pipe lines, is responsible for one very large item in the annual bill chargeable to rust.

We frequently hear the statement that the pipe made at present is inferior to that of "the good old days." Many old-time pipe liners tell us that the pipe laid years ago was much better than the pipe of today. It lasted longer, and there was less trouble from corrosion. While the latter statement itself is partially true, the deduction usually made is false. The pipe of today is as good as, or possibly better than, that of yesterday from the corrosion resisting standpoint; but it is, nevertheless, true that shorter life and more corrosion trouble is frequently found on recent pipe lines. There are at least five reasons for this: Location, stray current, paralleling of lines, increased moisture content of soil, and difference in level. In other words, most corrosion is caused by the environment rather than by metallurgical differences in pipe.

When the white man came to America, he was first of all an agriculturist. He picked out fertile soil for his farms and soon communities grew up in their midst. Cities were built and gas and water mains laid. The soil was from its very nature rather "mild." Severe soil corrosion is seldom found in naturally fertile soil. So the pipe laid in our first eastern cities was "good pipe."

New Factors

In the last decade of the nineteenth century, the use of electricity had become widespread; and both domestic power and electric railway systems were installed with ground returns. High electrical potential differences were set up between different parts of the ground, and stray current electrolysis began to cause corrosion troubles. The life of the pipes became shorter, and the fallacy grew up in the late nineties that pipe was not as good as it used to be.

As communities grew in size, the old pipe lines became inadequate for the service demanded of them. New lines were laid beside the old and connected to them. While the older lines had not failed due to corrosion, they had, nevertheless, become covered with a hard layer of rust,

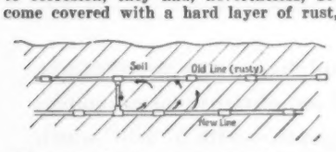


Figure 1—Showing current flow from new to old line due to ferric hydroxide (rust) potential.

usually ferric hydroxide ($Fe(OH)_3$). A rather efficient galvanic cell was formed, as shown in Figure 1, in which the new pipe was anodic to the old, with the result that rapid corrosion frequently took place on the new line, ferric hydroxide being cathodic to iron by about 0.65 volts. The new lines thus appeared to be made of poorer material than the old because they did not last as long.

As cities grew, the older part became business sections and pavements were built over the pipe lines. The newer residential districts became populated by a class of people who took pride in the appearance of their homes and well kept lawns and gardens. Water was applied in large amounts, in order to keep the lawns green; and this extra water became a factor in accelerating corrosion of service pipes. Once again the fallacy grew that "they don't make pipe like they used to."

In the meantime, the population had spread over lands which were not naturally fertile. Alkali beds were drained and cultivated, long pipe lines were laid across country, and irrigation was resorted to. The higher salt content of dry lands and the addition of water for irrigation made a very bad combination for buried pipe lines. Again the proponents for the old-time pipe came forward with their arguments.

The first pipes laid in the East were for water and gas lines, and were all below "frost level." Lines laid in the new West, particularly in California and Texas, were laid closer to the surface. Oxygen concentration cells of nearly 100 per cent efficiency were set up which greatly stimulated corrosion. And we still hear the old-time criticism that pipe made today is not as good as the pipe of olden times.

This brief summary shows five reasons why the belief has become prevalent that the pipe of today is inferior to that made in the past. It is, therefore, evident that the environment to which the pipe is subjected is a very important factor in pipe line corrosion; and an attempt is made in this paper to evaluate those factors which are responsible for rusting of pipe, so that it will no longer be necessary to lay a line and wait for time to tell us that the soil is corrosive.

Theoretical Consideration

It may be considered proven that soil corrosion is an electrolytic phenomenon. Part of the process is fairly well understood, and some general deductions can be drawn.

The first law of electrolysis was enunciated by Michael Faraday. Faraday's law may be loosely interpreted for our purposes to state that the amount of iron lost by a buried pipe due to soil corrosion is proportional to the quantity of electricity flowing from the pipe to the soil. Roughly, if 1 ampere of current flow into the soil for one year, it carries about 20 pounds of iron with it in the form of rust. Our first general statement, then, is that corrosivity C is proportional to current I, or

$$C \propto I \qquad (1)$$

Ohms law gives the relationship between current "I," electromotive force E, and resistance R. It states that current is proportional to electromotive force and inversely proportional to resistance, or

$$I = \frac{E}{R} \qquad (2)$$

therefore, corrosivity

$$C \propto \frac{E}{R} \qquad (3)$$

Whenever an electrolytic reaction takes place, decomposition products are formed which set up a counter electromotive force. This value called by physical chemists the decomposition potential E_d must, therefore, be subtracted from the causation potential E_c in order to obtain the value of E for the above equation, or

$$E = (E_c - E_d) \qquad (4)$$

Figure 2 shows schematically about what happens when a pieces of iron is buried in the soil. For some reason, to be discussed later, a difference of potention E_c exists between two points, A and B, of the buried iron. A current of electricity starts to flow from A through the soil to B and back through the metal to A as shown, thereby completing the circuit. The iron rusts at the anode A. Electrically, the resistance of the metallic part of the circuit is so small compared

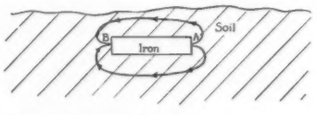


Figure 2—Showing soil currents set up by buried iron.

with that of the soil, that it may be neglected. Furthermore, the actual resistance of the soil path is difficult to determine, but it is proportional to the resistivity or specific R_{sp} of the soil. For purposes of comparison, therefore, the relative corrosivity of the soil may be taken as:

$$C = \frac{k\,(E_c - E_d)}{R_{sp}} \qquad (5)$$

where k is a constant, which for purposes of relative measurement is usually taken as 1,000. This is the fundamental equation for corrosivity. It is discussed in detail below.

Causation Potential E_c

Referring to Figure 2, it was stated that a difference of potential exists between two points, A and B. This potential may be caused by several things, such as:

1. Mill scale on point B (potentials of about 0.45 volts).
2. Red rust at B (potential about 0.65 volts).
3. Segregation of impurities, such as sulphur, carbon, slag, etc., in the iron at B (potentials up to 0.275 volts).
4. Electrolytic differences (potentials up to 0.3 volts).
5. Differences in salt concentration (potentials up to 0.1 volts).
6. Differences in gas concentration (potentials up to 1.4 volts).

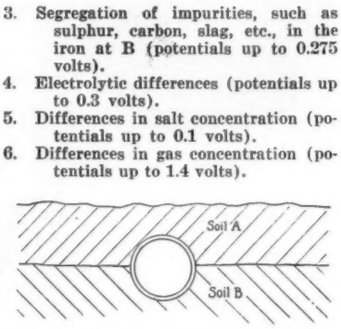


Figure 3—Showing pipe buried in two types of soil.

The points A and B may be very close to each other or hundreds of feet apart. Items 4, 5 and 6 perhaps need further explanation.

Suppose in Figure 3 the pipe is buried at the junction of two soil strata, A and B. If the soils are of different chemical composition, there will be a difference of potential between the top and bottom of the pipe. This is due to a difference in electrolyte mentioned above in item 4.

If now the two sections, A and B (Figure 3) have the same chemical composition, but one section contains more moisture than the other, again there will be a potential difference between the top and bottom of the pipe due to a difference in concentration of the dissolved salts (item 5). Even if the salt content and concentration of the two sections is the same, if the dissolved air or other gases in the soil moisture differs, there will be a potential set up (item 6). This gas concentration potential is, it is believed, the most important of all causes of potential difference, and may reach a value as high as 1.4 volts when there is dissolved air on one section and no air on the other. The efficiency of this reaction probably depends on soil texture, drainage, conditions, etc.

Decomposition Potential E_d

If two top plates, A and B, are immersed in an electrolyte and connected

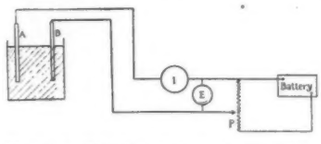


Figure 4—Showing method of determining decomposition potential of simple electrolyte.

through the meters and potentiometer to a battery as shown in Figure 4, a curve, Figure 5, may be drawn between the readings of the ammeter I and voltmeter E

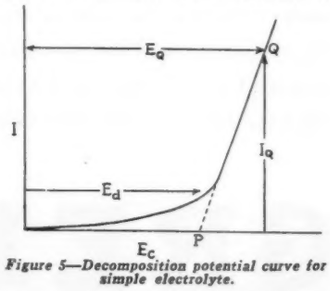


Figure 5—Decomposition potential curve for simple electrolyte.

for various settings of the potentiometer.

Beyond point P the electrolyte obeys Ohms law: i.e., the current is proportional to increase in voltage. The voltage

*Presented at eleventh annual meeting, American Petroleum Institute, at Chicago, Ill., November 13, 1930.

of point P is called the decomposition potential E_d of the electrolyte. Figure 6 shows curves made with various concencentrations of sodium chloride, and indicates that E_d is about 0.55 volts for sodium chloride, irrespective of the salt concentration. This potential does vary, however, for different metals, the value given being for iron plates. For values of potential below P, very little current flows; and unless the causation potential E_d is greater than the value F_d, there will be little, if any, corrosion. Decomposition potentials for soils vary from 0 to 1.7 volts, and are a very pertinent factor in soil corrosion. If the electrolyte is not a simple salt solution, it has been found that the method of Figure 4 cannot be used to determine E_d. If, however, the resistance R of the electrolyte be measured between the two plates by means of an alternating current bridge, the decomposition potential may be calculated if the readings for any point Q are known, for

$$I_Q = \frac{E_Q - E_d}{R}$$

or

$$E_d = E_Q - I_Q R \qquad (6)$$

Resistivity R_{sp}

Soil conductivity depends on many factors, such as packing, salt content, organic matter, moisture, etc. The effect

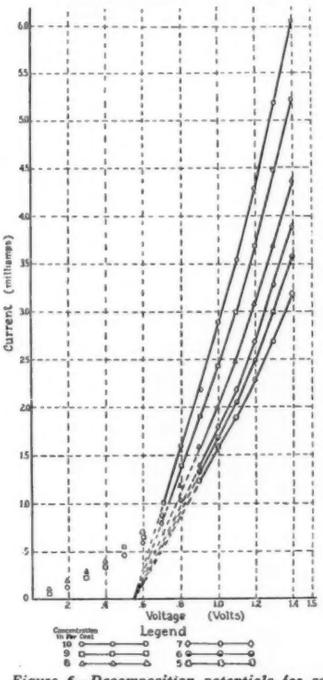


Figure 6—Decomposition potentials for sodium chloride solutions.

of pressure or soil packing is easily seen from Figure 7. In this case the soil sample under test was compressed in a testing machine and resistivity measurements made under various pressures. It is probable that the rise in resistance beyond point B is due to squeezing out water under high pressures. For purposes of comparison, soils under test should be compressed to point A, beyond which the resistivity is constant.

Moisture, however, is by far the most important variable in soil resistivity. In Figure 8 it will be seen that soil resistance varies markedly with moisture content. As the moisture content is increased, the resistivity drops rapidly, finally becoming nearly constant until the mud point P is reached, beyond which the salt solution becomes diluted with an increase of moisture. It may be noted here, however, that unless the average integrated moisture content is known, no relative measurements of corrosivity will be of value, it being evident that a soil sample taken which has the moisture content of point A when the integrated average for the year is that of point B will show the soil to be only about one-fifth as corrosive as it will be found in practice. Conversely, if the sample is taken under unusually moist conditions, soil which is normally almost inert may appear to be very corrosive.

Many tests have been devised in which soil is saturated with distilled water, with the result that fairly noncorrosive soils have often been thought corrosive; and a great deal of pipe treatment has been needlessly applied, incurring useless expenditures of thousands of dollars.

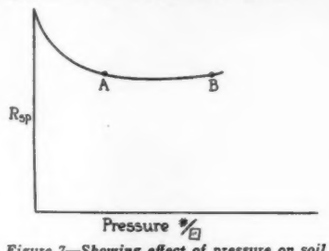


Figure 7—Showing effect of pressure on soil resisitivity.

Practical Applications

In making a soil corrosivity survey over a pipe line right of way, samples should be taken at the actual depth of the bottom of the proposed line. These samples should immediately be sealed in glass jars and sent to the laboratory for test. Glass top pint fruit jars with etched numbers have been found very satisfactory for this purpose. The numbers have been etched on the jars by a very simple process. Heavy paper stencils are first cut and pasted on the jars. A light sandblast of fine sand is then used over the stencil, which is then washed off, leaving the desired marking permanently etched on the glass.

In the laboratory, tests are made for moisture content, resistivity and corrosivity. If the moisture content is not the yearly integrated average, some of the sample should be dried, ground and brought to the average value by the addition of distilled water before the electrical tests are made.

Electrical Tests

The sample for test is compressed in a bakelite box between two steel end pieces which have been previously cleaned by rubbing on emery cloth. The dimensions of the box are such that the final result is a soil cube of unit dimensions. Connections are made as shown in Figure 9, which, for the sake of clearness, does not include the retaining bakelite box. The switch is first thrown to position B and a resistivity measurement made on a slide wire bridge, using alternating current to eliminate polarization effects. The switch is then thrown to position C, the potentiometer having been adjusted until the voltmeter E shows a causation potential E_c of 1.4 volts. The curve, Figure 10, shows the relationship of current and time.

When the switch is first closed, the full causation potential E_c of 1.4 volts acts on the soil, which, being a unit cube, has a resistance of R_{sp}. The current at zero time, therefore, from Ohms law:

$$I_0 = \frac{E_c}{R_{sp}} \qquad (7)$$

As this current starts to flow, decomposition products are built up on the

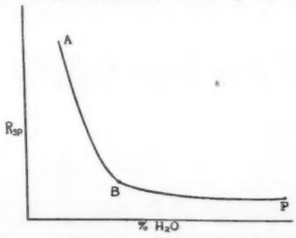


Figure 8—Showing effect of moisture on soil resistivity.

steel end plates, setting up a counter potential which reaches the decomposition potential E_d in from 5 to 10 minutes. The current value, then, is:

$$I_{10} = \frac{E_c - E_d}{R_{sp}} \qquad (8)$$

which is identical with equation 5, if the ammeter reading is in milliamperes and the constant k is 1,000.

This current reading in milliamperes,

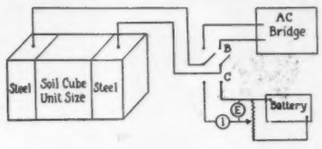


Figure 9—Diagrammatic sketch of corrosivity measuring equipment.

therefore, is the corrosivity C of the soil if causation potential E_c is 1.4 volts.

The adoption of 1.4 volts as a causation potential was not arbitrary, but the result of a rather extended investigation of some 48 soils in the San Joaquin Valley. Weighed samples of clean iron were buried in these various soils whose moisture content was kept fairly constant for a period of six months. At the end of that time, the samples were cleaned and weighed and the resulting corrosion loss obtained.

The resistivity R_{sp}, and decomposition potential E_d, were measured for each soil, and calculations were made for C from equation 5, assuming a value of 1.0 volts for causation potential E_c. A curve was then plotted between the values of C and the actual corrosion loss found with the weighed samples. This curve is shown at A, Figure 11.

Another series of C values was computed assuming a value of E = 2 volts. Curve C was the result of this computation. When, however, 1.4 volts was used for the E_c value, curve B was obtained. If equation 5 is true, the values of C and actual loss should plot a straight line: therefore, E_c is about 1.4 volts.

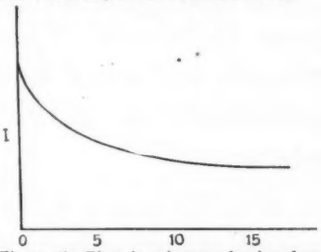


Figure 10—Time in minutes, showing drop in current with time.

Incidentally, 1.4 volts is the value that would be found if the causation potential was set up by an air or oxygen concentration cell of 100 per cent efficiency.

Moisture and Rainfall

The fact that soil resistivity varies so sharply with moisture makes it necessary to establish an integrated average of moisture content before making a corrosivity measurement. It is necessary to know the average rainfall in the terrain under test and the time of the last rain before the sample was taken. Then

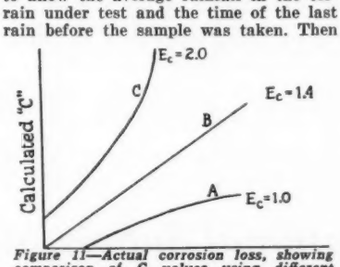


Figure 11—Actual corrosion loss, showing comparison of C values using different values of E.

from a knowledge of soil texture, drainage, etc., the integrated average can be estimated. At the present time information along this line is needed probably more than any other soil corrosion factor, and it is hoped that men in all sections of the country will add to our knowledge as soon as possible. During the last year, monthly samples have been taken at several of the stations along the San Joaquin Valley trunk lines of the Standard Oil Co. of California and are reproduced in the accompanying table, Table 1. It should be remembered that these readings are taken in a drought area where the normal rainfall is from 4 to 15 inches per year, and is of little value in other parts of the country.

Long Line Currents

It sometimes happens, however, that the potential causing corrosion is not acting between two closely adjacent points in a uniform soil, but between two points widely separated, the soils at these points being different from each other in moisture, salt content, aeration and other properties. Long line currents are then set up as shown in Figure 12, where the soil at point A may differ from that at point B, with a resulting current flow through the pipe and ground as shown. The corrosion at point A is greater than would be expected from the corrosivity test of soil A, while that at

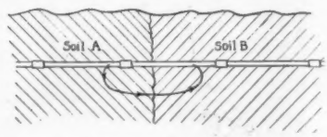


Figure 12—Diagrammatic sketch of long line currents.

B is less than a measurement of its sample would indicate.

The effect of such currents may be important when the soil resistivity is very low, and a method of predetermination should be developed, but to date no simple test has been devised.

TABLE 1—MOISTURE DATA

Walt Pump Station

Month—	Per cent moisture	R_{sp}	E_d	C
January	*2.5	*4,000	760	*0.16
February	2.4	4,400	960	0.10
March	2.2	5,500	795	0.11
April	2.2	4,000	680	0.18
May	2.2	4,500	815	0.13
June	2.6	4,400	960	0.10
July	1.8	5,000	1,000	0.08
August	1.8	5,200	1,036	0.07
September	0.8	10,000	1,100	0.03
October	*1.4	*5,250	1,085	*0.06
November	*1.9	*5,000	1,050	*0.07
December	*2.2	*4,200	980	*0.10
Average	2.4			0.10

Notes—*Estimated. Soil—Delano sandy loam. Soil taken at 24 inches. Yearly rainfall—4 inches. Average integrated moisture—2.4 per cent.

San Pablo Tank Farm

Month—	Per cent moisture	R_{sp}	E_d	C
January	*28.0	*250	490.0	*3.5
February	29.6	250	525.0	3.5
March	26.6	200	560.0	4.2
April	34.1	200	640.0	3.8
May	26.9	160	680.0	4.0
June	18.4	400	520.0	2.2
July	16.8	450	545.0	1.9
August	15.0	500	550.0	1.7
September	14.6	525	612.5	1.5
October	*15.0	*500	550.0	*1.7
November	*17.0	*450	545.0	*1.9
December	*23.0	*250	650.0	*3.0
Average	22.0			2.7

Notes—*Estimated. Antioch clay loam. Soil taken at 24 inches. Yearly rainfall—15 inches. Average integrated moisture—22.0 per cent.

Kernell Test Yard

Month—	Per cent moisture	R_{sp}	E_d	C
January	*12.2	*28	792	*16.0
February	12.3	35	805	17.0
March	12.6	54	590	15.0
April	14.9	28	896	18.0
May	11.6	43	798	14.0
June	16.2	55	795	11.0
July	10.4	75	613	10.5
August	10.0	80	600	10.0
September	14.9	30	890	17.0
October	*13.0	*50	800	*12.0
November	*13.0	*55	795	*11.0
December	*12.5	*52	620	*15.0
Average	11.5			13.8

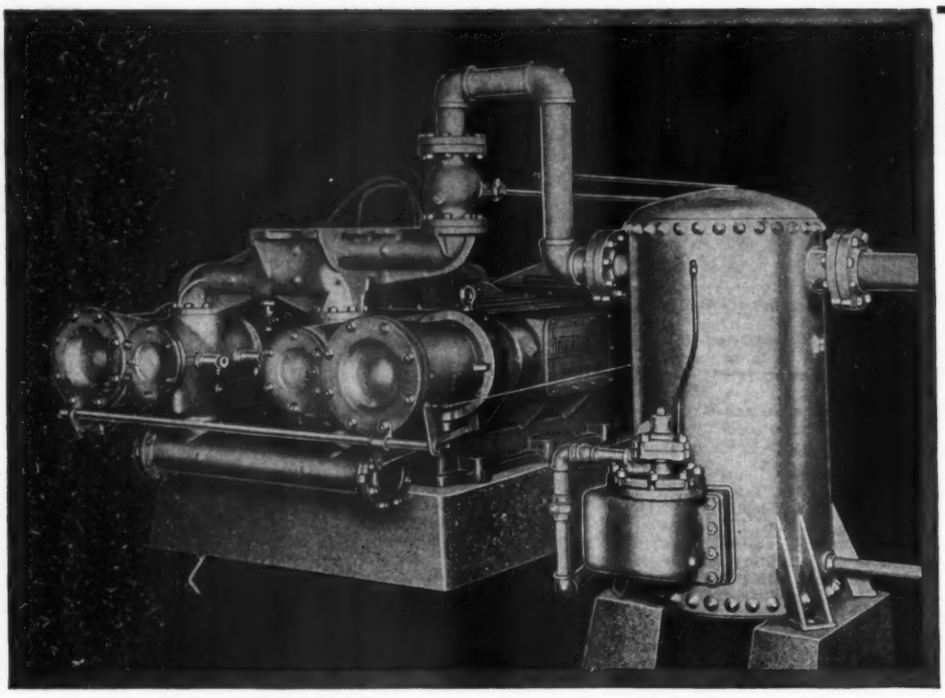
Notes—*Estimated. Fresno clay loam. Soil taken at 24 inches. Yearly rainfall, 4 inches. Average integrated moisture, 11.5 per cent.

Emerald Pump Station

Month—	Per cent moisture	R_{sp}	E_d	C
January	*16.0	380	602	*2.1
February	17.3	400	520	2.2
March	13.9	320	600	2.5
April	16.2	360	544	2.1
May	16.2	390	620	2.0
June	16.3	390	620	2.0
July	13.3	350	665	2.1
August	13.0	375	650	2.0
September	13.3	360	680	2.0
October	*13.0	350	700	*2.0
November	*14.0	320	760	*2.0
December	*15.0	400	560	*2.1
Average	16.0			2.0

Notes—*Estimated. Yolo clay loam. Soil taken at 24 inches. Yearly rainfall, 7 to 8

(Continued on Page 187)



6,627

IDEAL-AJAX 12x12 Roller Bearing Piston Valve Engine with extra-heavy, large-capacity Steam Separator. This equipment is meeting the demands for speed made possible with latest improvements in drilling tools and superheated boilers.

For over 50 years Ajax has pioneered in new features of steam engine design for oil well drilling. The new piston valve, roller bearing engines are saving contractors and operators thousands of dollars in labor and drilling costs and unexpected days and weeks in time in drilling deeper wells.

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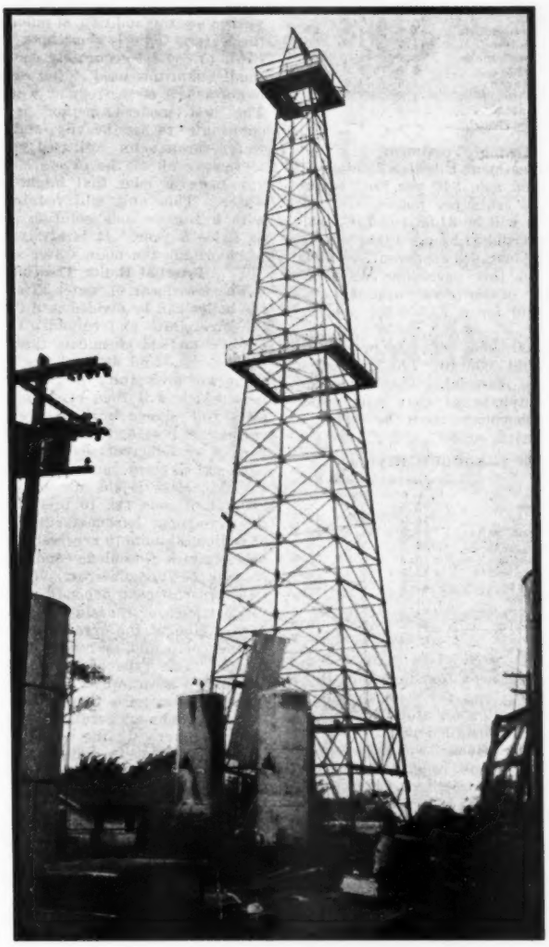
Feet.. Actual Drilling Time 34 Days



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Drilled by J. E. Mabee with IDEAL-AJAX Roller Bearing Twin-Cylinder Engine with large size Separator.

Total Depth	6,627 feet
Started Rigging Up	July 24th
Drilling Completed	Sept. 19th
Total Pay Roll Time	57 Days
Total time rigging up, waiting on cement, coring and bailing	23 Days
ACTUAL DRILLING TIME	34 Days

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ROLLER BEARING

STEAM DRILLING ENGINES

Made by AJAX IRON WORKS, Corry, Pa.

ADAPTATION OF FLASH WELDING ANNOUNCED

(Continued from Page 102)

similar to forging. The exuded metal gathers as beads on the inner and outer surface of the joint with the oxide forming a coating on top of the metal. The oxide coating and the bead on the inside are sufficiently removed to permit drifting according to A.P.I. specifications. On the outer circumference of the joint, the oxide is removed, leaving only a small dense pad of metal. The pipe is finally subjected to careful inspection and a thorough hydrostatic test.

It is possible to produce a joint satisfactory to the oil and gas industry by careful use of the acetylene process, followed by exacting inspection, and a joint, so made, will meet A.P.I. specifications.

Microphotograph of metal at weld in J & L double length pipe joined by flash welding method.

The acetylene welder has difficulty in controlling temperature to take care of construction and expansion in the material.

In the flash welding process, the weld is made at just the proper temperature, the application of heat being controlled and varied with the material to be joined. Oxidation and decarburization are practically eliminated, as are strains due to uneven contraction and expansion, for the two lengths of pipe are heated over the entire ends simultaneously, instead of one point at a time. In the J & L process there is no element to cause formation of blow holes. Any blow holes which might tend to form, or any oxide which is produced, are pushed out

Microphotograph of parent metal of pipe to be joined by J & L flash welding process.

of the weld by the forging action taking place as the two lengths of pipe are pressed together.

The micrographs attached show the grain structure produced by the flash welding method now employed by J & L.

The equipment used in the J & L adaptation of the flash welding process is of special design and has been installed at a considerable cost. This development places the Jones & Laughlin Steel Corp. in a position to fill large orders on short notice.

WATER SUPPLY AND TREATING METHODS

(Continued from Page 102)

proper pH value to protect the pipe line against corrosion, is suitable for preparing mud-laden fluid, will not cause scale in boilers, will prevent corrosion in cooling and condensing systems, and will not cause scale in cooling systems unless it is concentrated unduly. There are no uses for water on oil leases for which this type of treated water is unsuitable.

Zeolite Softening

The zeolite method of softening water produces a water of practically zero hardness but does not change it in any other way. Turbid water must be filtered before passing through a zeolite softener. Zeolite is a general term referring to a class of hydrous sodium aluminum silicates possessing base exchange properties, that is, the sodium of the zeolite is exchanged for the calcium and magnesium of the water. When the capacity of the zeolite is exhausted it is regenerated by washing with a 5 per cent sodium chloride brine. This excess of sodium forces out the calcium and magnesium and restores the zeolite to its original condition. The quantities of salt used with modern zeolite vary from 0.3 to 0.5 pound per 1,000 grains hardness removed.

A zeolite softener consists of a steel tank containing the zeolite mineral supported on a bed of graded gravel and equipped with the necessary valves and pipes to distribute uniformly the incoming hard water, remove the soft water and handle all the operations connected with salting the zeolite and washing out the excess salt. One very desirable feature of zeolite softeners is that up to the capacity of the unit a water of varying hardness will be uniformly softened to zero hardness. There is eliminated the necessity of accurately proportioning the chemicals to the water as in the lime soda process.

The chemical control of zeolite softening consists of adding five drops of a standard soap solution to 40 cc. of the softened water and shaking to produce a

Cracked Gasoines

lather. If no lather is produced the softener needs regeneration.

Water properly softened by the zeolite method will not protect a pipe line against corrosion and will not protect circulating systems against corrosion unless the pH value of the water is raised to a point comparable to that of lime treated water. No scale will be formed in either cooling jackets or boilers.

Cost of Softeners

The installed cost of the average lime soda softener will amount to about $40 per barrel per hour capacity. Thus a 25,000-bbl. per day softener would cost about $40,000. Zeolite softeners cost from $5 to $15 per 1,000 grains hardness capacity, the variations in flow rate and time between regenerations governing the unit price. There should be noted an essential difference between lime soda and zeolite softeners. A lime soda unit of a given size has the same capacity on a water of almost any hardness, while the capacity of a zeolite unit varies inversely as the hardness of the water. Thus a lime soda softener of 10,000 bbls. per day capacity will handle that volume whether the hardness be 10 grains or 50 grains. A zeolite softener would require five times as much zeolite to soften a 50-grain water as would be required for a 10-grain water.

From the standpoint of water softening, waters can be divided into four general classifications:

1. Very low hardness and very high sodium bicarbonate.
2. Temporary hardness only.
3. Moderate amount of permanent hardness in addition to temporary hardness.
4. Very large amounts of permanent hardness, usually called "gyp waters."

Typical Analyses

Typical analyses expressed in grains per gallon with the treatment required and the suitability of the waters for use follow:

CLASS 1—SOURCE, WELL

	Grains per U. S. gal.
Total hardness	1.2
Total alkalinity	23.4
Total dissolved solids	31.3
Calcium carbonate	0.7
Magnesium carbonate	0.4
Sodium sulphate	3.0
Sodium chloride	3.5
Sodium carbonate	22.3
Suspended matter	0.7

This water cannot be treated for softening nor does it need filtration. It will cause corrosion of lines and cooling surfaces but will not produce scale. There will be considerable danger from caustic embrittlement in boilers, the sulphate-carbonate ratio being 1 to 10.

This type of water usually occurs in deep wells through certain sections of the country and is not often found as a surface supply.

CLASS 2—SOURCE, WELL

	Grains per U. S. gal.	Lime soda	Zeolite
Total hardness	17.8	3.0	0.0
Total alkalinity	22.2	8.2	22.2
Total dissolved solids	28.5	13.5	29.0
Calcium carbonate	11.7	3.0	0.0
Magnesium carbonate	5.2	...	...
Sodium chloride	5.0	5.0	5.0
Sodium carbonate	4.6	4.6	22.2
Free carbon dioxide	1.0	0.0	1.0
Suspended matter	2.4	0.0	2.4
Sodium hydroxide	...	0.6	...

Cost of Treatment

Cost of treatment based on lime at $15 per ton; soda ash, $40 per ton; sodium aluminate, 6 cents per pound, and salt, $10 per ton, will be $1.68 per 1,000 bbls. for lime soda and $1.87 per 1,000 bbls. for zeolite. The installed cost would be about the same on this particular water for either type of softener, approximately about $40,000 for a 25,000-bbl. per day plant.

Each 1,000 bbls. of this water untreated would contain 120 pounds of scale-forming material. The water contains no sulphate so that with either treatment phosphate must be added to prevent embrittlement.

CLASS 3—SOURCE, RIVER

	Grains per U. S. gal.	Lime soda	Zeolite
Total hardness	32.5	3.0	0.0
Total alkalinity	16.1	5.0	16.1
Total dissolved solids	54.9	45.0	56.2
Calcium carbonate	16.1	3.0	0.0
Calcium sulphate	8.5	0.0	0.0
Magnesium sulphate	12.0	0.0	0.0
Sodium sulphate	12.9	35.8	35.8
Sodium chloride	4.3	4.3	4.3
Free carbon dioxide	1.2	0.0	1.2
Suspended matter	84.6	0.0	0.0
Sodium carbonate	...	1.0	17.1
Sodium hydroxide	...	1.0	...

Cost of treatment for lime soda is $4 per 1,000 bbls. and for zeolite, using a price of $40 per ton for alum is $3.82 per 1,000 bbls. The installed cost of a 25,000-bbl. per day softener would be about $40,000 for a lime soda softener and about $90,000 for zeolite. Clarification of this water so that it can be applied to the zeolite necessitates the use of a plant almost identical with the lime-soda ash plant so that the zeolite cost includes the lime-soda cost.

If the source of this supply was from wells instead of a river and consequently no clarification was required, the cost of the zeolite plant would be about $50,000. Each 1,000 bbls. of this water contains 700 pounds of scale-forming material, of which 500 pounds is suspended matter and 200 pounds dissolved calcium and magnesium salts.

The lime soda treated water will have a sulphate-carbonate ratio of 18 to 1 while the ratio of the zeolite treated water will be only 2.2 to 1. There is no danger of caustic embrittlement with the lime soda treated water but for high operating pressures sodium phosphate will be required with the zeolite water.

CLASS 4—SOURCE, WELL

	Grains per U. S. gal.	Lime soda
Total hardness	119.5	3.0
Total alkalinity	28.8	8.0
Total dissolved solids	237.1	217.1
Calcium carbonate	28.8	3.0
Calcium sulphate	46.9	0.0
Magnesium sulphate	67.2	0.0
Sodium sulphate	69.6	197.6
Sodium chloride	23.5	23.5
Free carbon dioxide	3.0	0.0
Suspended matter	0.1	0.0
Sodium carbonate	...	1.5
Sodium hydroxide	...	3.5

Cost of treatment will be $17 per 1,000 bbls. with the lime soda method. A zeolite softener cannot be used on this water because of its extremely high hardness and total dissolved solids. The installed cost of a 25,000-bbl. per day softener will be about $40,000.

Each 1,000 bbls. of this water contains 450 pounds of scale-forming material. The sulphate-carbonate ratio is 40 to 1.

An effort is sometimes made to utilize salt water for cooling purposes. The cost of treating salt water is prohibitive. About the only remedy for corrosion is the addition of some substance which will form a surface film, the most suitable being sodium chromate. It seems unnecessary to say that salt water should never be used if water from any other source is available.

Water supply for domestic use in camps generally requires purification before it is satisfactory or safe for use. Softened water is of course more acceptable for family use and the water must be clear, odorless and tasteless to be palatable. Sterilization is nearly always accomplished by the addition of chlorine gas to the water. This is sometimes rather difficult to control accurately enough in the small quantities used if the camp supply is not a part of the regular water system. The best modern method is to overchlorinate rather heavily and pass the water through an activated carbon unit to remove all of the excess chlorine and any taste or odor that might be in the water. This unit will require washing with a caustic soda solution about once or twice a year. It is always desirable to chlorinate the main water supply.

Internal Boiler Treatment

The treatment of water after it enters the boiler can be divided into two classes, the precipitate and colloid. In the precipitate method chemicals that react the same as lime and soda ash are used. Heat alone will precipitate the temporary hardness which will then exist in the water as a fine sludge unless there are other substances present to assist in the formation of an adherent scale. Probably the most satisfactory internal treatment under this class is the use of the correct amount of soda ash to precipitate all of the permanent hardness and the amount of sodium aluminate necessary to give the precipitate a flocculent condition so that it will be nonadherent. The colloidal type of treatment depends upon coating the particles of the sludge as they form with a film of the organic material used in the compound to render them nonadherent. This type of treatment is more successful with water containing only temporary hardness than with those containing permanent hardness in addition to the temporary. In the use of compounds it should be borne in mind that the boiler is being used as a reaction tank and there is being formed a considerable amount of precipitate which will necessitate much greater "blow-down" than would be the case if externally softened water was used. The cost of this method of treatment is ordinarily much higher than if the water was softened before being introduced into the boiler. A thorough discussion of boiler compounds will be found in "Boiler Feed Water Purification," by Powell.

Until recently little study has been made of the problems incidental to the economical development and efficient treatment of the water necessary in a modern development campaign. The foregoing paper is submitted in the hope that it will stimulate further study of this important subject.

Acknowledgments

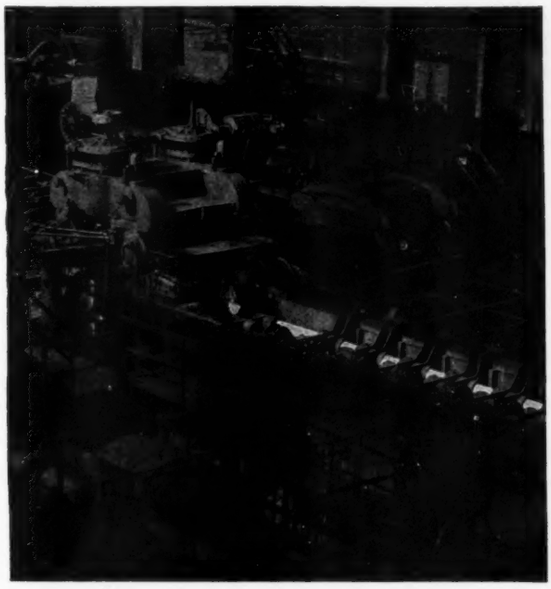
The Mid-Continent section of the central drilling committee wishes to express its appreciation to Lawrence K. Cecil of the International Filter Co., John T. Hayward of the Shell Petroleum Corp. and K. A. Covell of the Indian Territory Illuminating Oil Co. for their work in preparing this paper.

DIESEL ENGINE USED ON WELL IN MONTANA

W. M. Fulton, head of the Fulton Petroleum Co., is drilling a well on the Milk River Dome, Glacier County, northern Montana, on Section 28-36-12w, with the hole at 850 feet, with a Diesel engine. This type of power plant is an innovation in this part of the oil country and through its use, Mr. Fulton expects to obviate the necessity of shut downs due to blizzard conditions that, in the past few weeks have caused most of the drilling operations in Montana to suspend. With the Diesel type of power plant, the water needs of a drilling well are reduced to a minimum and the water supply is negligible when compared to the requirements of a steam plant. The well is known as No. 1 Blackfoot.

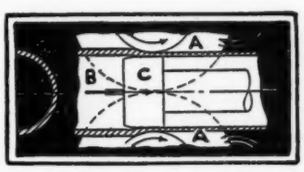
J & L SEAMLESS

Produced under Finest Control in the Heaviest Plug Mills in Existence

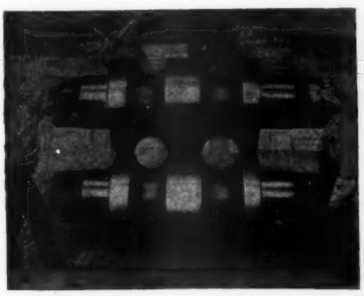


The picture shows one of the powerful J & L plug mills, the largest and heaviest in existence.

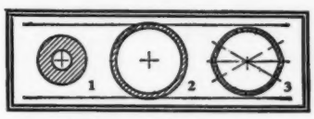
FACILITIES of J & L for making Seamless Casing, Tubing and Drill Pipe of highest quality are unsurpassed. For instance, J & L employs the heaviest plug mills in existence for producing all sizes of seamless from 2⅜" O.D. to 13⅜" O.D. By using this extra heavy equipment J & L has reduced detrimental vibration to a minimum, and has obtained as nearly perfect control as possible over an operation highly important to making seamless of superior quality. In the plug mill a denser steel structure and the correct weight per foot are obtained as the tube is rolled to approximately the exact wall thickness. The more thoroughly the plug mill does its work the greater will be the endurance and dependability of the finished pipe.



Sketch of plug mill operation in seamless manufacture. "A" are the rolls, "B" is the tube, and "C" is the plug over which the tube is rolled.



The picture at the left indicates the giant size of the rolls employed in the J & L Seamless Pipe plug mills.



Development of cross-section of J & L Seamless Pipe: 1. After first piercing; 2. After second piercing; 3. After plug mill rolling.

JONES & LAUGHLIN STEEL CORPORATION

AMERICAN IRON AND STEEL WORKS

J&L STEEL

Manufacturers of Seamless and Welded Casing, Tubing, Drill Pipe and Line Pipe, and Welded Steam, Gas and Water Pipe in both Black and Galvanized.

Also makers of Bars, Shapes and Plates, Reinforcing Bars, Cold Finished Steel, Junior Beams, Steel Piling, Fabricated Structural Work, Steel Barges, Wire Products and Tin Mill Products.

JONES & LAUGHLIN BUILDING, PITTSBURGH, PENNSYLVANIA

Of Interest to Sales Departments

SINCLAIR SUMMARIZES ITS STATION PURCHASES

NEW YORK, Nov. 10.—The Sinclair Refining Co. announced today that up to the end of October it had bought this year the facilities and business of 59 petroleum marketing companies, operating in 17 states. This does not include the facilities of the Pierce Petroleum Corp., acquisition of which was previously announced. The Sinclair Refining Co. is the chief domestic marketing subsidiary of the Sinclair Consolidated Oil Corp.

These 59 companies represented 1,511 bulk distributing plants, service stations and "resale" or dealer outlets. In addition to these acquisitions, the Sinclair company has bought from individual distributors 7 bulk plants and 52 service stations, and has obtained under long-term leases 10 bulk plants and 169 service stations.

Divided by states, the companies whose business has been taken over are as follows:

Alabama: Petroleum Products Co., La Fayette; Consumers Oil Co., Bay Minnett.

Arkansas: Home Oil Co., Ashdown; Royal Oil Co., Little Rock; Warden Oil Co., North Little Rock; Burton Oil Co., Nettleton; Guenters, Inc., Little Rock.

Connecticut: Thomaston Land & Improvement Co., Thomaston; Paramount Oil Co., New Haven.

Georgia: Marion County Oil Co., Buena Vista.

Illinois: Kay Oil Co., Pontiac; Red Eagle Oil Co., Canton.

Louisiana: Liberty Products Co., Ponchatoula.

Michigan: Des Jardins Oil Co., Marquette; Decker Oil & Gas Co., Decker.

Mississippi: Winston Oil Co., Noxapater.

New York: Seider Oil Co., Hamburg; Superb Oil Co., Haverstraw; Fay C. Adams Oil Co., Syracuse area; Kissan Oil Co., Watkins Glen; Conine & Cooper, Bath.

North Carolina: Piedmont Oil Co., Gastonia; Imperial Gas & Oil Co., Winston-Salem; Napoleon Oil Co., Marion; Cleveland Oil Co., Shelby.

Ohio: Public Service Oil Corp., eastern central Ohio; H. R. Johnson Oil Co., Baltimore; Court Gas & Supply Co., Marietta; Regal Oil Co., Piqua; Community Oil Co., Jackson Center.

Pennsylvania: Crader Oil & Supply Co., Towanda.

South Carolina: Swansea Gas & Oil Co., Sawnsea; Superior Oil Co., Batesburg; Calvert Oil Co., Abbeyville; Citizens Oil Co., Seneca.

Texas: Brazos Oil Co., Richmond; Sanders Oil Co., Brenham; Blalock's Tire Store, Huntsville; Gerlach Brothers, Livingston; Dixon Oil Co., Burton; Home Petroleum Co., Huntsville; Arnst Brothers, Kingsville; Willis Mercantile Co., Willis; Home Petroleum Co., Madisonville; Waller County Oil Co., Waller; Home Oil Co., Sweetwater; Douphitt & McAskill, Edinburg; Eagle Lake Grain Co., Eagle Lake; Perry Oil Co., Freeport.

Virginia: Fulton Oil Co., Gate City; Russell Gas Co., Hanaker; Midland Oil & Gas Co., Abington; Blue Ridge Oil Co., The Plains; U. S. Oil Co., South Hill; Monticello Oil & Gas Co., Charlottesville; Central Oil Co., Norton.

West Virginia: Arrowhead Gasoline Co., Cameron.

Wisconsin: Conley Oil Co., Eau Claire; Eagle Oil Co., Shawano.

CHANGE IN LOAD LINE SOUGHT

NEW YORK, Nov. 3.—Representatives of petroleum companies and oil tanker owners and operators met here with the members of the United States load line committee for preliminary discussions regarding the permitting of tankers operating coastwise to load more deeply. Under the existing load-line regulations, the same rules apply to tankers operating coastwise as in foreign runs. Oil companies have expressed the opinion that conditions in the coastwise trade are much less hazardous, and they are seeking permission to load coastwise ships from one-quarter to one-half inch more per foot of draft. Among the interests represented at the hearing were Sinclair, Standard of New Jersey and Gulf Refining.

CALIFORNIA GASOLINE SALES SHOW INCREASE

LOS ANGELES, Calif., Nov. 10.—Tax figures released by the State of California showing the volume of motor fuels sold during the third quarter of 1930 indicate that all of the major oil companies have increased their business during the period. Comparing the third quarter of 1930 with the corresponding three months of 1929, General Petroleum Corp. shows the greatest percentage of gain, having sold 30,683,291 gallons this year, as against 16,213,257 gallons in the third quarter of 1929, an increase of 89.24 per cent.

During July, August and September 357,199,256 gallons of gasoline were distributed in California, a gain of 6.8 per cent over the same period in 1929.

Comparative figures of gasoline sales of seven major companies for the quarter just ended and the corresponding 1929 period, and also of the second quarter of 1930, were reported as follows:

	Gallons third quarter		Pct.
	1930	1929	Increase
Stand. Oil Co.	73,421,611	67,663,270	8.51
Shell Oil Co...	54,585,191	53,533,193	1.96
Richf. Oil Co.	40,901,557	42,484,231	*3.72
Union Oil Co.	33,966,512	29,338,323	15.77
Assoc. Oil Co.	33,532,743	24,733,750	35.57
Gen. Pet. Corp.	30,683,291	16,213,257	89.24
Texas Co.....	13,853,343	12,217,556	13.38

	Third quarter 1930	Second quarter 1930	Pct. Increase
Stand. Oil Co.	73,421,611	74,384,809	*1.29
Shell Oil Co..	54,585,191	61,156,615	*10.74
Rich. Oil Co..	40,901,557	39,283,491	4.11
Union Oil Co.	33,966,512	35,119,278	*3.28
Assoc. Oil Co.	33,532,743	27,235,962	23.11
Gen. Pet. Corp.	30,683,291	27,790,331	10.40
Texas Co.....	13,853,343	13,974,294	*.86

*Decrease.

SHELL ADDS TO AIR FLEET

The Shell Petroleum Corp. has added a Bellanca Skyrocket to its fleet of aircraft. It recently lost its tri-motored Fokker in a million-dollar fire at the Chicago municipal airport. With the Bellanca, Lockheed-Vega and Travel-air "Mystery" ship this company has available at all times fast air transportation for its officials to enable them to keep in close touch with their widespread interests.

MONAMOTOR BUYS POCAHONTAS

COUNCIL BLUFFS, Iowa, Nov. 8.—The Pocahontas Oil Co., of Pocahontas, Iowa, has been bought by the MonaMotor Oil Co. of this city. Pocahontas has bulk and service stations. A controlling interest in MonaMotor was acquired recently by the Barnsdall Corp., which made the purchased organization its distributing agent for Iowa. A branch of the Great Lakes pipe line will be built to Council Bluffs.

BARNSDALL OFFICES TO MOVE

CHICAGO, Nov. 8.—The local sales office of the Barnsdall Refineries, Inc., will be moved soon from 624 South Michigan Avenue to the new Buckingham Building on Van Buren Street, just west of Michigan Avenue. Announcement of a list of jobbers in and near Chicago who have been taken over by the Barnsdall Corp. is to be made.

EXPORTS AND IMPORTS DURING SEPTEMBER, 1930

By Charles E. Kern

Washington Bureau, The Oil and Gas Journal

WASHINGTON, D. C., Nov. 10.—Exports of crude oil during September amounted to 1,960,887 bbls. valued at $2,754,872, compared with 1,988,126 bbls. valued at $2,963,388 in September, 1929. These exports during the nine months ending September aggregated 18,433,605 bbls. valued at $25,489,851 compared with 18,856,909 bbls. valued at $26,462,286 during the same period of the previous year, according to the monthly summary Bureau of Foreign and Domestic Commerce. Of the quantity exported, 1,720,802 bbls. of crude went to Canada in September and 14,716,571 bbls. in the nine months' period of this year.

Refined oils exported in September amounted to 8,262,235 bbls. valued at $29,788,492, compared with 7,876,698 bbls. valued at $33,498,550 in September, 1929. During the nine months' period ending September the exportation of refined oil aggregated 95,425,399 bbls., being an increase from 92,221,207 bbls. exported in the same period of 1929.

Gasoline exports in September were 3,912,452 bbls. valued at $16,483,969, compared with 4,241,355 bbls. valued at $18,850,848 in September, 1929.

Illuminating oil exported in September amounted to 1,349,070 bbls. valued at $4,607,394, compared with 1,100,953 bbls. valued at $5,025,409 in September, 1929.

Of lubricating greases 7,078,372 pounds were exported in September compared with 12,320,702 pounds in the same month of 1929.

Of paraffin wax 30,170,115 pounds were exported compared with 31,987,294 pounds in September, 1929.

Crude petroleum was imported in September to the extent of 5,807,983 bbls. valued at $6,203,615, compared with 6,952,565 bbls. valued at $6,575,129 in the same month of 1929.

All petroleum and its products imported in September amounted to 13,157,230 bbls., compared with 11,297,243 bbls. in September, 1929.

Of the crude imported, 2,756,526 bbls. came from Venezuela, 1,412,526 bbls. from Mexico, 1,284,400 bbls. from Colombia, and 968,713 bbls. from The Netherlands West Indies.

The imports included 1,538,275 bbls. of gasoline valued at $5,289,612, compared with 900,846 bbls. valued at $3,067,233 imported in September, 1929. During the nine months ending September imports of gasoline aggregated 13,264,425 bbls. valued at $46,524,660, compared with 6,108,170 bbls. valued at $33,713,362 in the same period of 1929.

TO WHOLESALE TIRES

NEW YORK, Nov. 11.—Standard Oil Company of Kentucky, in announcing this week its entry into the tire business, will both wholesale and retail automobile tires.

W. E. Smith, president, in announcing that the company will market automobile tires throughout its territory in Kentucky, Alabama, Florida, Georgia, and Mississippi, said: "The growing demand for more complete and exacting service by the motoring public makes this addition to our business a necessary and logical one. The tires offered will be first line and first quality in every respect and will be made by experienced and reliable manufacturers.

"A special feature of the company's plan is that of offering tires to independent dealers operating filling stations and garages. Tires will be offered to these dealers on a wholesale price basis, assuring them satisfactory profits. It will be the desire of the company to co-operate with and include these resellers in its tire selling program, rather than disturb the business of these dealers, many of whom are valuable customers of the company on petroleum products.

"The company will guarantee every tire sold, whether by its dealers or service stations. This plan provides for a 12 months' guarantee, regardless of mileage, on all tires sold for use on passenger cars, and six months' guarantee, regardless of mileage, on all tires sold for use on commercial cars."

RAILROAD CONSUMPTION OF FUEL OIL DECLINES

WASHINGTON, D. C., Nov. 8.—Fuel oil consumed by locomotives of the 157 steam railroads of the United States in August amounted to 184,468,004 bbls., a decrease from 209,786,082 bbls. consumed in the previous August. Including direct freight charges this fuel oil had an average cost per gallon in August, 1930, of 1.99 cents, a decrease in price from 2.10 cents in the previous August.

During the eight months ending with August, 1,561,321,313 gallons of fuel oil was consumed by these railroads, a reduction from 1,679,693,732 gallons in the same period of the previous year. During these eight months in 1930 the average price paid for the fuel oil was 2.01 cents, comparing with 2.15 paid in the similar period of 1929.

Coal consumption by these railroads decreased from 9,026,156 net tons in August, 1929, to 7,623,614 tons in August, 1930, and the price per ton decreased from $2.41 in August, 1929, to $2.34 in August, 1930.—C. E. K.

LION EXTENDS MARKET

NEW YORK, Nov. 11.—Lion Oil Refining Co. of El Dorado, Ark., has further extended its retail marketing activities during the past three months, according to T. H. Barton, president.

In a letter to stockholders, Mr. Barton says: "During the past quarter we have added 50 controlled outlets for refined products, making a total of 251 bulk and filling stations owned or controlled in Arkansas, Mississippi, Tennessee, and Louisiana.

"Our production of crude oil is holding up remarkably well, averaging now over 7,500 bbls. a day.

"General business conditions have been very bad and the condition of the oil industry is no exception, but your company is conserving its working capital, acquiring additional outlets for refined products and also other properties where it can be done on a favorable basis, and we will be in an advantageous position when general business conditions improve."

DELAWARE ORDERS INQUIRY

NEW YORK, Nov. 10.—Governor Buck of Delaware has directed State Attorney General Reuben Satterthwaite, Jr., to prepare indictments against all petroleum companies marketing gasoline in Delaware, charging them with conspiring to stifle competition by maintaining a uniform and fixed price for gasoline.

The governor alleges that one large oil company fixes the retail price of gasoline, which quotation is always followed by all other companies selling in Delaware. He declared that he seeks to have gasoline sold in Delaware at the same price which prevails in New Jersey, Pennsylvania and other nearby states. A number of oil companies, the governor declared, have informed him of their willingness to reduce their posted prices if their competitors do likewise.

The posted price for service station gasoline in Delaware is 21 cents per gallon, against 19 to 21 cents in Pennsylvania and 15.5 to 16.5 cents in New Jersey.

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IMPROVED PORTABLE

BOLTED TANKS

(Capacities From 40 Bbls. to 27,500 Bbls.)

Designed by a pioneer manufacturer of steel products for the oil industry—made of the finest open-hearth, blue-annealed, copper-bearing steel by master craftsmen, COLUMBIAN BOLTED TANKS embody individual characteristics that have won for them a superlative position in the world's most important fields.

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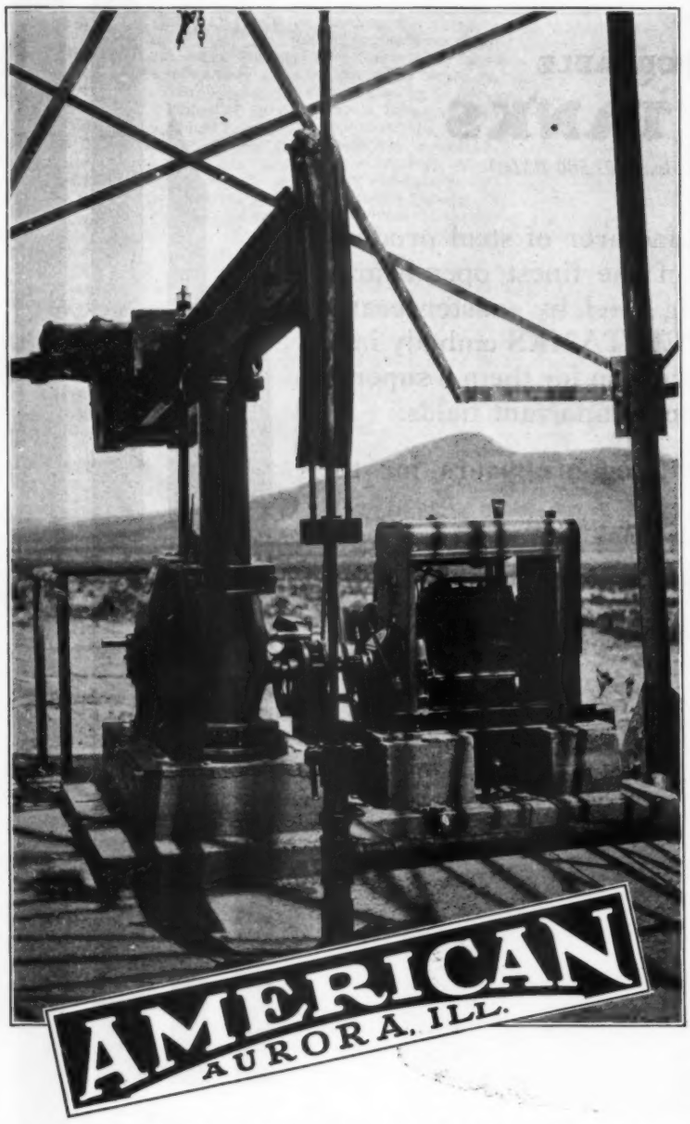
PIONEERS

AN "AMERICAN" WITH GAS ENGINE



PICTURED is an "American" No. 4-A Fig. 1822 oil well pumping unit direct connected to a gasoline engine.

"American" units have been particularly designed to meet the various drive requirements of different localities. "American" units are adaptable for pulley, V-belt or direct drive by gasoline engine or electric motor.

Detailed figures and engineering data of typical installations of this equipment in both this country and others are available. Ask for them!

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New York City
165 Broadway

Los Angeles, Calif.
416 E. Third St.

THE AMERICAN WELL WORKS
General Offices AURORA, ILLINOIS *and Factory*

NEED FOR OBTAINING ADVERTISING VALUE

(Continued from Page 136)

this cost is figured into the "per unit cost" of the article or product advertised. However, if it were carried through under its proper charge, undoubtedly more value would be secured out of this method of advertising, for the reason that as long as this cost is charged to operating expense, the operating department will naturally neglect the appearance of the equipment in order to keep their operating costs down; while if such costs were set up as an advertising item, the unit would not be allowed to lose its attractiveness.

In many cases, companies feel that it is good advertising to have their cars used only by their salesmen painted with company color schemes and monograms. This method of advertising, while good from a sales viewpoint, has its bad feature in that the company sacrifices the cost of a repaint job when the unit is disposed of, and the question is raised as to whether the value of this method of advertising is sufficient to offset the loss sustained when the unit is traded in. Assuming that advertising on automobile equipment is equal to other outside methods of advertising, and considering the length of time such equipment would ordinarily remain in service, it would seem that the loss sustained in the trade-in is well warranted.

Expense Merited

Undoubtedly the additional expense incident to the use of automotive equipment for advertising purposes will bring some discussion from the automotive operating departments, as this additional cost of painting and lettering, under the present distribution arrangement, would tend to increase automotive operating expense (as such costs are now being wrongfully charged to that account); but:

Since our companies spend thousands of dollars perfecting trademarks and trade names, why not take advantage of the advertising medium provided by the road equipment we must of necessity maintain, and use it to help in keeping before the public these trademarks and trade names, letting the expense involved be absorbed where it rightfully belongs—in the advertising budget.

PROPER SELECTION OF OIL WELL CASING

(Continued from Page 155)

the possibility of the hole being under diameter, can readily cause the freezing of casing. That this is a cause of the difficulty is evidenced by operators failing to set casing at the proper depth, and after pulling the casing and further reaming or underreaming then to successfully complete the job.

The recent accomplishment of drilling holes with little deviation from the vertical will aid in the success of setting casing. Though no decrease in clearance ratios can now be detected as a result of this improvement in technique, arguments on its advantages in setting casing are readily acceptable, and the assumption is justified that clearance ratios in the future will be reduced when the proportion of straight holes is greater.

A.P.I. Standard Casing Lists

The present A.P.I. lists of standard casing, lapweld and seamless, cover nine sizes and 32 weights, and the supplementary lists cover seven sizes and 25 weights, making 16 sizes and 57 weights in all. In addition to these, the recently added alloy casing list, Grade D, contains nine sizes and 20 weights. This appears to be excessive; but, if the available space between strings is to be definitely proportioned (clearance-ratio method) numerous sizes and weights must be used to meet the conditions of variable friction depths, collapse, and tension stresses, and the largest reasonable number of sizes and weights available will permit of the best designed, or proportioned, casing strings. The several casing programs shown in Tables 2 to 8, inclusive, in which an effort has been made to use A.P.I. sizes, illustrate in several instances the advisability of more sizes to better proportion the space. This is quite evident in String 2 of Table 4, wherein the casing specified permits drilling a hole 19 inches in diameter when the required hole diameter for setting the 13⅜-inch casing is only slightly over 18 inches. This particular case also brings out the need of a 20-inch casing in the A.P.I. lists, as the casing shown for String 1, although generally used, is not an A.P.I. size. The use of sizes by the operators which will permit better proportioning the space will eventually establish these sizes, and their consideration by the Institute will then follow as a logical course.

Conclusions

Although this paper advances the clearance-ratio method as a logical means of designing casing programs, it is not within its scope to advance definite clearance ratios for any and all fields because of the variable conditions that may only be determined by actual experience. However, it is believed that the method proposed will lead operators to consider the same factors in designing programs, and thereby at least arrive at some semblance of uniformity within individual fields. An approach to uniformity will mean decreased casing stocks which will reduce casing costs, and thereby ultimately meet the major desire of all operators to carry on their development work at a minimum cost.

Acknowledgments

Acknowledgment is made to the following members of the California District Drilling Practice Committee and others who have obtained the field data and made valuable comments which have been incorporated in this paper:

Ralph Copley, Standard Oil Co. of California, Los Angeles, Calif.; M. N. Phillips, Continental Oil Co., Los Angeles, Calif.; P. C. McConnell, Standard Oil Co., Taft, Calif.; F. J. Shaver, Shell Oil Co., Ventura, Calif.; E. P. Tallant, Union Oil Co. of California, Santa Fe Springs, Calif.; L. A. Cranson, Elwood Exploration Co., Santa Barbara, Calif.; and R. A. March, Shell Oil Co., Los Angeles, Calif.

SUGGESTIONS ON WHY AND HOW OF PIPE PROTECTION

(Continued from Page 140)

the Mid-Continent area, has reached the conclusion that soil corrosion is still a vital problem. In his opinion, the failures of pipe coatings that have occurred on pipe coated prior to two or three years ago are not worthy of much consideration.

This latter conclusion is based on the fact that he is satisfied that application methods in use prior to two or three years ago were very poor, and that failures of such pipe coatings can be attributed not entirely, but largely, to this fact.

This view is substantiated to a great extent by the fact that two or three years ago he began insisting upon better and more careful application of coatings. He has had occasion to examine his coated lines that have been installed within the last two or three years, and, generally speaking, has discovered that the pipe has been adequately protected to date.

There have been failures, but in every case these have occurred where this company had always had consistent trouble in the past. In other words, these are "hot spots," and this engineer has come to the conclusion that failures in these hot spots are not due to chemical disintegration of the coating material or to soil distortion, but to some sort of electrochemical action.

Coat Trunk Lines When Laying

His extensive study of this subject has convinced him that pipe coatings are necessary and are of value, if they are applied properly. It is his opinion now that a new oil trunk line, and especially one of large diameter should be entirely coated while it is being laid.

One reason for this conclusion is that he has found the reconditioning of large pipe lines so expensive that it really cannot be undertaken. As a consequence, it is his opinion that every effort should be made to prevent any such reconditioning

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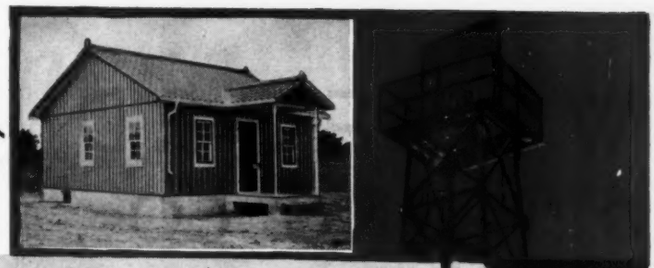
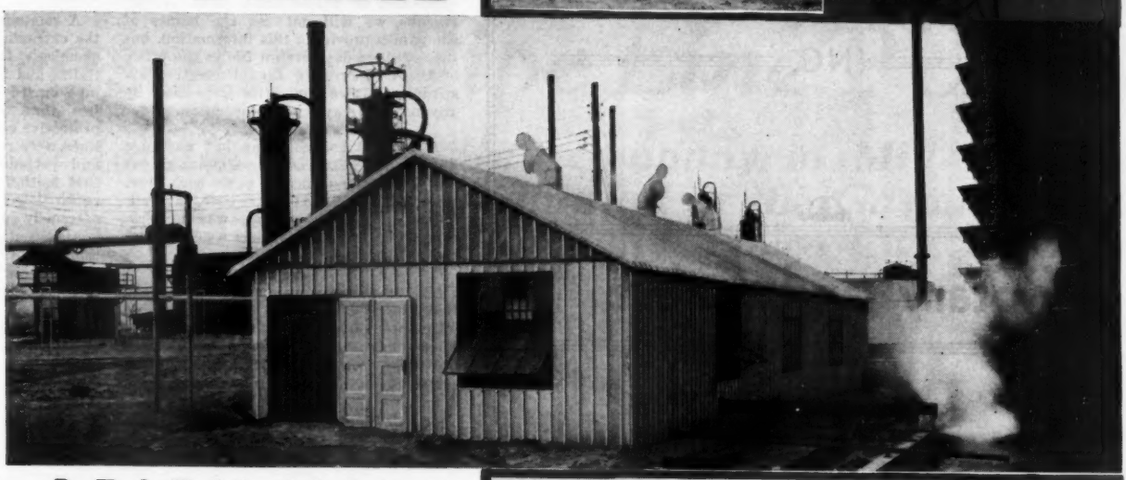
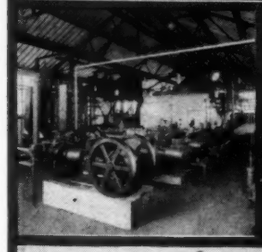
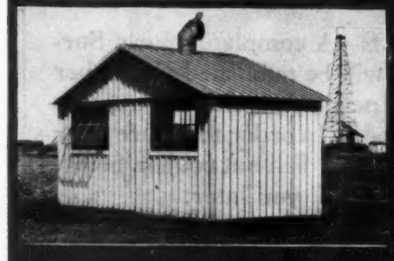




READY-MADE STEEL BUILDINGS Shelter Every Oil Field Activity





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ever being required, and the only way to accomplish this is to apply a good protective coating while the line is being laid.

We wish to acknowledge our indebtedness to this prominent engineer for permission to cite his experience in showing the progress made in protecting pipe lines during the past few years, as well as for the other important points covered in his statement. We are also citing a few actual experiences of pipe line owners, showing the economic justification for proper protection of buried lines. For obvious reasons we will not use the names of companies providing this information, but the complete data are on file in the office of the Underground Pipe Protection Institute, and we invite its inspection by anyone who may wish information.

Case 1

A natural gas company had gas pipe lines in and near Claremore, Okla., go out due to corrosion once or twice each year, prior to 1925. At that time, a well-known protective coating was applied. Since then no corrosion has occurred and the pipe is being protected.

Case 2

The same company, at a location near Red Fork, Okla., had a 12-inch pipe line which went out once or twice each year. Since the application of a well-known protective coating in 1925, no further corrosion has been experienced.

Case 3

An oil company reconditioned a 12-inch line in Avoyelles Parish, Louisiana, and applied a well-known protective coating in 1922. When reconditioned, this line was badly pitted. The average life of unprotected pipe at this location is six to eight years. Eight years has been added to the life of this line to date. A new parallel line was coated at the same time, and is also in good condition at the present time.

Case 4

An oil company reconditioned a 10-inch line near Beaumont, Tex., in 1926 after it had been in service four years. The pipe had pitted badly on the bottom. A well-known protective coating applied at the time of reconditioning has added four or five years to the life of this line to date.

Case 5

A gas company in West Virginia reconditioned a 6-inch line in April, 1927, and applied a well-known protective coating. No pitting had occurred, but pipe in this location had an average life of only six months. The coating has lengthened the life of this line three years to date.

Case 6

A California oil company reconditioned a 6-inch line in 1922, which had pitted. The average life of unprotected pipe at this location was two years. The coating added three years to the life of the pipe, which was reconditioned again in 1927.

Case 7

A Connecticut gas company replaced a small diameter line running through a salt marsh near Long Island Sound in 1928. This line had been laid originally in 1926, and had been eaten through in several places and was badly pitted over its entire length during its two-year life. Since the application of a well-known protective coating in 1928, no trouble from corrosion has been experienced and both coating and pipe are still in excellent condition.

Case 8

A 72-inch steel water main in Brooklyn, N. Y., was coated inside and outside for a considerable portion of its length with a well-known protective coating in 1914. Examination a few months ago showed that the coating and the pipe are still in excellent condition, and the line has not yet started to deteriorate. Sections of the same line, not properly protected, were in very bad condition. An unprotected branch cast iron pipe laid in the same location in the same year, examined at the same time, showed considerable deterioration from tuberculation and rust.

Case 9

A California oil company laid a 170-mile line in 1914-15, part of it through an irrigated section and the rest through highly alkaline soil. A well-known protective coating was applied over its entire length. Examination was made by independent engineers 12 years later at 58 widely separated points which were subject to the worst conditions of corrosion. The engineers reported that the coating and pipe still were in excellent condition, except for several hundred feet which were replaced. This line, which is now about 17 years old, still is in service, and the coating is rendering protection.

Case 10

A company operating a large plant for the extraction of borax, potash and other chemicals from a lake shore at Trona, Calif., had found by experience that steel pipe buried in this location had a life of less than six months. A well-known protective coating was applied when these lines were replaced more than a year ago, and periodic examinations have shown that neither the coating nor the pipe has suffered from deterioration. Despite this extremely corrosive soil situation, the protective coating has lengthened the life of this line by 100 per cent to date.

Case 11

A large oil company laid a new line in 1926 from a refinery in Illinois to the Chicago district. The line, which was protected when installed with a well-known protective coating, was located at the refinery, at a spot where caustic soda used in cleaning tank cars saturated the soil covering the line. Obviously, this resulted in a bad corrosive condition, and was confirmed by the fact that steel fence posts at the same location were soon destroyed. Recent examinations showed coating and pipe in perfect condition.

Economically Sound

These examples show clearly that the practice of using dependable pipe coating materials is economically sound, and that the increased life of properly protected lines is ample justification for the investment in coatings. This opinion was recently substantiated by the Federal Oil Conservation Board in its report to President Hoover, from which the following extract is quoted:

"Corrosion is an important factor in determining the cost of a pipe line. The amount of expenditure warranted for protective pipe coatings depends upon the nature of the soil in which the pipe is to be laid and the relative corrosive effects of the soil. The economic value of good pipe coatings has become more and more appreciated during the past few years. Many operators are using costly pipe coatings, and experience has proved that such protections are economically justified. Frequently, the life of a pipe line in the ground may be prolonged 50 per cent by the application of proper pipe coating."

A similar sentiment has been expressed by Stanley Gill of the research department of the Gulf Oil Corp., who has given this subject careful study and whose writings are widely read in the oil industry.

"Much progress has been made, and is being made," Mr. Gill states, "in the development of coatings for the protection of buried pipe lines. Many really effective coating systems are available, and numerous improvements and developments are to be expected. It is significant that more and more use is being made of more or less expensive coating systems; that the present tendency is to use coatings of proven effectiveness rather than to coat lines with materials whose most important qualifications are that they are 'black and cheap'."

These comments are representative of the opinion held by many experienced pipe line operators and engineers. This is particularly true, in many cases, if long experience and intimate study and association with the problem have been possible. On the other hand, engineers or operators who have not enjoyed the advantages of long-time actual contact with pipe line corrosion and its prevention in their daily work frequently overlook its importance when suddenly confronted with the building of a new big line. A bare or inadequately protected line usually results, with the possibility of ex-

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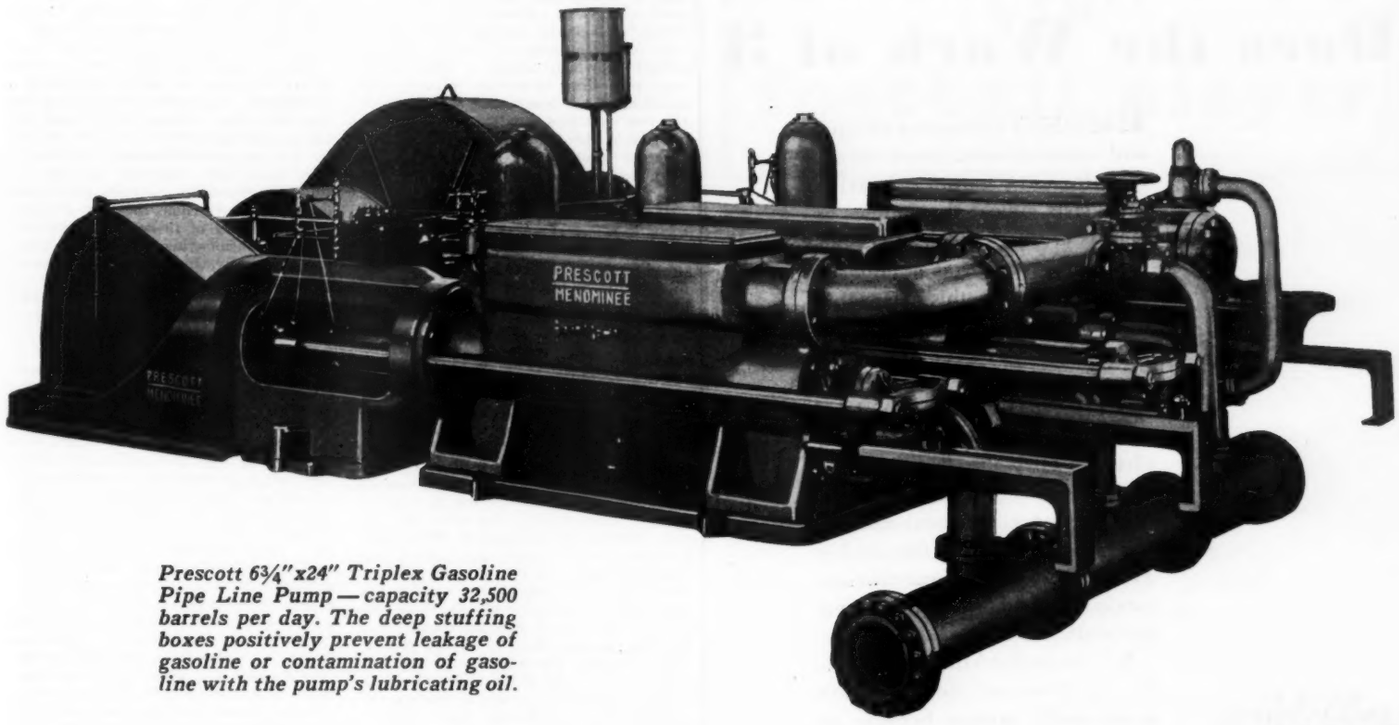

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pensive reconditioning to be faced in later years.

Protection Sometimes Questioned

Occasionally, the importance of pipe corrosion or the effectiveness of existing protective measures is questioned. The most recent and notable of these were papers by Charles Fitzgerald of the Pure Oil Pipe Line Co. and Gordon N. Scott, research associate of the American Petroleum Institute.

Mr. Fitzgerald contended that the importance of corrosion had been overemphasized, while presenting data intended to show that pipe coating materials had fallen short of meeting the need in Spindle Top Gully and other notorious "hot spots." He also cited instances showing that actual replacements of pipe, due to corrosion losses, were small. The exact condition of the rest of these lines was apparently considered good, but it seems evident deterioration must have occurred. Obviously, this is a loss of investment; deserves recognition, and puts the matter in a different light. As for the performance of coatings applied to pipe buried in these "hot spots," it must be borne in mind that any failures of the better coatings were unquestionably due to the recent discovered phenomenon of "soil stress." Engineers and operators will decide for themselves, of course, whether or not they can afford to place buried steel pipe lines in service without safeguarding their investment, and whether the few examples cited last year by Mr. Fitzgerald should affect any program of pipe construction now under way or contemplated for the future.

Soil Stress

Doctor Scott's paper, covering examinations only in the Southwest and California, was concerned principally with the subject of "soil stress," and naturally this factor suddenly assumed enormous proportions. Pipe line operators and engineers were apparently as unfamiliar with its existence as were coating manufacturers. It is evidently one of these unexpected things constantly cropping up in life and best described as "acts of God."

It should be remembered that the function of a pipe coating is to protect the pipe; and the distortion of the coating, while disturbing, does not necessarily mean the coating has failed in this respect. Consequently, the only satisfactory method of determining this condition is to remove all coating from a substantial length of pipe—say several hundred feet—and thoroughly examine the pipe itself for corrosive effects. The condition of the pipe before the coating was applied, the effectiveness of the preliminary cleaning, the exact conditions surrounding the application and subsequent handling conditions should be known and studied in considering the subject. Furthermore, apparent failures due to soil action should be separated from those due to other causes. Examinations made on coated pipe lines where soil distortion is a local condition should be offset by examinations in the much greater remainder of the country where this phenomenon does not exist. A considerable number of such examinations have subsequently been made, and have shown the reputable coatings were unchanged and the pipe in as good condition as the day it was laid.

Fortunately, the first impression gained from Doctor Scott's paper has given way to a more rational appraisal of the situation. However, considerable uncertainty resulted from his assertion that "most failures of coatings to prevent corrosion to the pipe are due to some form of soil action."

Carl Weidner, in his prepared discussion of Doctor Scott's paper, said :"Failure (of coatings) occurs, as the author points out, principally from soil stress effect, and not from any chemical deterioration of the material."

Variations in Soil Stress

While it is gratifying to have our own convictions as to the chemical stability of established coating materials thus confirmed, it would be dangerous to continue to lay too much emphasis on the damage caused by soil action. It should be remembered that, just as soils vary in their corrosiveness, so do they vary in the effects of soil stress. It seems probable that the extreme hot spots of soil stress can be safely considered as rare and as scattered as the hot spots of corrosiveness. During the past year it has been further ascertained that soil stress is a highly localized condition, which causes no trouble in most sections of the country.

If soil stress is allowed to become the bugaboo of the industry, dangers of wider importance may be overlooked. We grant that soil stress does exist and that in certain localities it is a real problem. Nevertheless, we believe that attention might better be centered on the greater problem, which accounts for a large proportion of the failures on coated lines and deserves consideration wherever pipe is in service—proper application of good coating materials to pipe properly prepared for that application.

Members of the Underground Pipe Protection Institute are working actively on the problem of soil stress, some by evolving coatings that in themselves present greater resistance than formerly to soil action, and others by the use of reinforcing materials surrounding or embedded in the coating material itself. It should be borne in mind that all anticorrosive measures are defensive measures; there first must be an attack before an intelligent counterattack can be launched. Just as a new disease is soon met with the proper antitoxin to check its ravages, so an exceptional subsoil condition is now being met with new or improved types of protective coatings particularly designed to overcome the new difficulty. Tests of many of these, under extremely severe conditions, are very encouraging.

Occasionally, the thought is advanced that pipe coating materials should be purchased on a specification basis. From long experience with their own products, manufacturers of various protective coatings are satisfied that it would be impossible to secure satisfactory coating materials in this way. This is largely due to the fact that present-day testing methods of such material are inadequate to control the admission of worth while products and at the same time entirely exclude all inferior ones. There are characteristics of pipe coating materials which have an important bearing on their performance, but at present are not measurable. Furthermore, none of the known methods of analysis can be expected to control selections of raw materials and details of processes involved in the production of reputable compounds. In addition, there is no satisfactory laboratory method of determining whether any particular compound, which passes all known tests, will subsequently suffer chemical disintegration due to age and thereby lose its effectiveness. It is possible that some day pipe coating materials can be satisfactorily purchased in this way, but it is out of the question at present. There is, therefore, no substitute in sight for the reputation and experience of reliable manufacturers and satisfactory records of performance in actual services of their materials.

Protection Depends on Proper Application

However, in the last analysis, the protection of pipe lines must depend upon proper application of coating materials. No pipe coating is any better than its application. Money spent for the best pipe coating in the world might just as well be thrown in the ditch if this coating is not properly applied.

It is a source of constant surprise to pipe coating manufacturers to find the greatest interest in this subject among executives of pipe line companies while negotiating for business, but later on in the field to find that this interest has not been transmitted to the field forces. The entire responsibility for applying properly thousands of dollars worth of pipe coating material, on which depends the future of millions of dollars worth of pipe, is found to be ultimately in the hands of men being paid from $4 to $8 a day. It might be wise for some of the larger pipe line companies, which have learned the importance of protecting their

other investments, to invest whatever is necessary in properly training their field crews, and of impressing upon them the importance of the work they do.

A preliminary application of the chosen pipe coating should be made at the pipe mill. The pipe surface is then new and, therefore, should be cleaner than can be expected later. A clean surface is a highly important matter—in fact, is imperative—for the proper performance of any pipe coating. It seems logical to expect, therefore, that the first application can be made on a better surface than if this application is delayed until the pipe is in the field.

Atmospheric Corrosive Agents

Another desirable reason for shop coating is that bare pipe or pipe coated with an inadequate mill coating is attacked, while in storage, while in transit, or while strung along the right of way, by the ever-present atmospheric corrosive agents. Corrosion, consequently, occurs; and extensive cleaning is required in the field before protective coatings can be properly applied. This cleaning is expensive, and introduces the hazard that it may not be performed satisfactorily. The performance of any coating would, consequently, be jeopardized. Shop coating eliminates practically all of this expense and also this hazard.

There is no difficulty or hardship connected with the proper application of pipe coating materials. It is merely a problem of proper procedure and intelligent preliminary planning, so that the pipe coating operations can be provided for in the general plan of construction without causing delays or necessitating poor workmanship. The American Petroleum Institute's code of good practice in the proper preparation of pipe for coating and the application of the coating material might well be made the "Bible" of the coating crew and its supervisors. It is well to remember, also, that a few hours or days saved by permitting an inferior application job will probably result in years lost from the ultimate life of the pipe line. Few operators would knowingly sanction such extravagance.

In this same connection, it should be emphasized that the proper handling of coated pipe deserves more attention from most pipe line builders. When a pipe has received its permanent anticorrosive protection, the coating is ready to protect the pipe against any enemy the soil may hold. If, through careless or unintelligent handling, the pipe's protective armor is badly mutilated, the battle against corrosion is practically half lost before the pipe enters the soil. For example, there would seem to be little need for pointing out that chains, wires and ropes should not be used wantonly in handling coated pipe; but there still are many pipe line operators who have not recognized the value and economy of using broad canvas or leather slings around coated pipe when moving it or lowering it into the trench.

From the foregoing discussion, and the facts we have presented, it will be seen that well-applied pipe coatings are economically justified by the increased life they give to buried pipe. This is the conclusion of many engineers and operating companies whose experience has led them to recognize the fact that a good protective coating is the cheapest insurance against untimely pipe failure. In stressing the primary importance of proper application of good and reputable pipe coating materials, we feel that we are pointing the way to the economical solution of the major problem involved in the protection of buried pipe lines.

CONTROL OF COLOR BY ACID TREATING

(Continued from Page 122)

come darker, proper allowance is made for this fact in subsequent determinations.

In measuring colors, the sample of the unknown oil is diluted so that its color approximates that of the standard. This has been found essential in order that the amount of light absorbed in the two cells may be equalized. The choice of diluent is likewise important in order to obtain truly attractive colors. Naphtha or refined oil solutions of light and moderately dark oils are too dark, due possibly to the dissociation of the color bodies; while with still bottoms and other dark oils the colors are too light, due to the precipitation of the asphaltic constituents. Medicinal white oil solutions give colors which are additive, but the high cost and viscosity of the oil are disadvantageous. A mixture of equal parts of extraction naphtha and white oil has proven very satisfactory.

The comparison between true color and the N.P.A. color scale is illustrated in Figure 1.

Study of Acid Treating

Solar reduced stock obtained from Seminole crude was chosen for the major part of the investigation of acid treating. Attention was concentrated on this stock for two reasons. First, it is a specific and recognizable cut among refiners; and, second, it forms the low viscosity oil base for the majority of the marketed motor oils. The stock had the following characteristics:

Gravity	25.1° A.P.I.
Viscosity at 70° F.	790 sec. Saybolt
Viscosity at 100° F.	286 sec. Saybolt
Viscosity at 130° F.	129 sec. Saybolt
Pour	25° F.
Flash	410° F.
Fire	470° F.
Water	Very slight trace
True color*	112–140

*In the course of four months the stock changed from 112 to 140 true color. The assumption is made that the difference between the original color "bodies" and those which developed on standing is of second order in respect to the action of sulphuric acid in removing them.

The stock was treated according to the standard laboratory procedure, with 97.8, 93.2, 90.7, 86.0, 82.6 and 75.0 per cent sulphuric acid over the range of 0.05 cc. to 9.5 cc. of acid per 100 cc. of oil. The tests were conducted at 80° F. ± 3° F., and the time of shaking was 40 minutes.

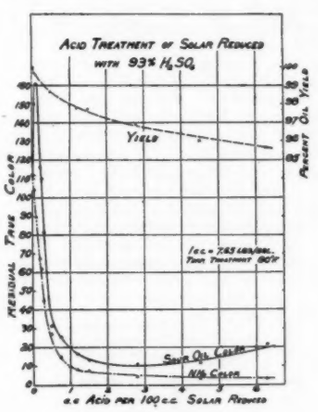
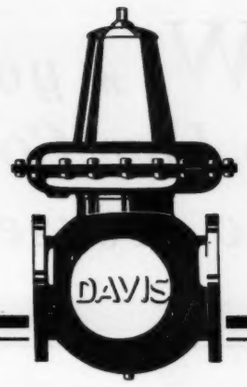


Figure 2.

The effect of the volume of 93 per cent treating acid on the sour oil and ammonia colors is shown in Figure 2. It should be noted that the sour oil color curve passes through a maximum color at 0.1 per cent acid, which is 48 color units or 43 per cent darker than the original stock color. The sour oil color reaches a minimum true color of 11 (2.7 N.P.A.) at 3 per cent (23 pounds per barrel) acid by volume, and increases steadily thereafter to 26.5 true color at 9 per cent acid. No such irregularities were observed in the ammonia colors of the heated oils. Here the acid functions immediately as a decolorizing agent, and a normal exponential curve is obtained.

The sour oil color curves obtained with the other concentrations of acid all show an initial increase in color, maximum at 0.1 per cent, but the degree of darkening apparently bears no relationship to the acid concentration. On the other hand, the darkening of the sour oil color due to excessive treating is greatest with 98 per cent acid and decreases regularly with diminishing concentration; 82.6 per cent acid darkens the color very slightly, and 75 per cent acid not at all.

The ammonia color, although a little



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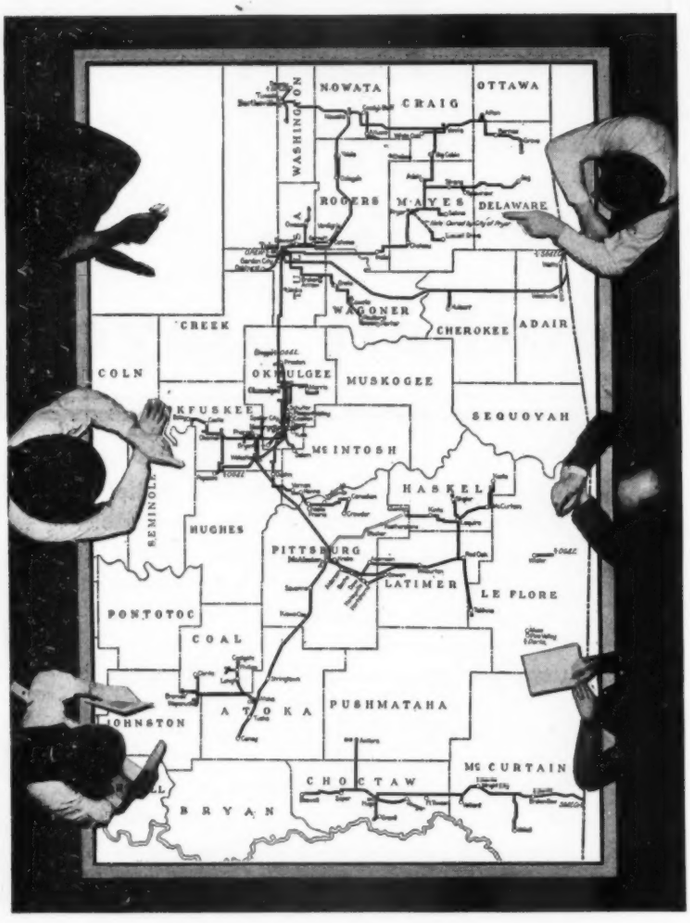

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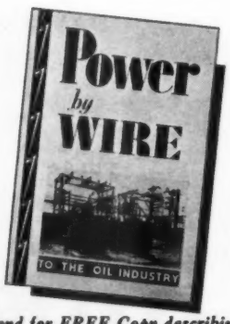

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light, resembles the caustic neutralized color much closer than does the sour oil. Where the sour oil is usually brown with a blue bloom, the ammonia color is a rich golden yellow, greatly improved in bloom. This change in color on neutralization with ammonia was found to be due to the presence of indicator-like bodies, for sour oils can be changed repeatedly from brown to yellow and back to brown by the alternate addition of ammonia and hydrochloric acid. This effect is easily observed with dark naphtha-fixed sour oils.

Color-Removing Efficiencies

For the purpose of comparing the color-removing efficiencies of the six strengths of acid, the ammonia color was chosen as the basis for comparison, because it is more accurately defined than the sour oil color and is closer to the plant caustic neutralized color. Figures 3 and 4 display on log paper this comparison, and show the final ammonia color and the per cent color removed as functions of the grams of sulphuric acid in the treating acid employed. The superiorities of 93 per cent acid are immediately apparent. Thus with 2 grams of sulphuric acid per 100 cc. of solar reduced stock (approximately 10 pounds, 93 per cent acid per 50-gallon barrel) colors ranging from 9 to 38 true color are obtainable, depending on the acid concentration. For 15 true color, 1.3 grams of sulphuric acid are necessary when the treating is accomplished with 93 per cent acid. To obtain this same color with 98 per cent, 90.7 per cent, 86 per cent and 82.6 per cent acid, 1.45, 1.7. 2.3 and 3.6 grams of sulphuric acid, respectively, are necessary.

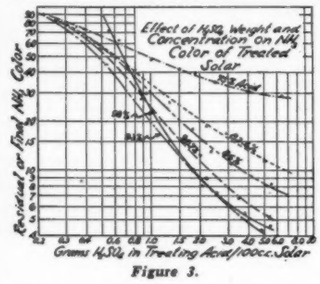

Effect of H2SO4 Weight and Concentration on NH3 Color of Treated Solar
Residual or Final NH3 Color
Grams H2SO4 in Treating Acid/100cc. Solar

Figure 3.

It is important to appreciate that the inferiority of the weaker acids was far in excess of the molal equivalence of the highest concentrations of acid. The color removal is less a function of the weight of sulphuric acid involved than of the concentration of the acid. The color removed is also shown to bear no relationship to the oil loss incurred in treating.

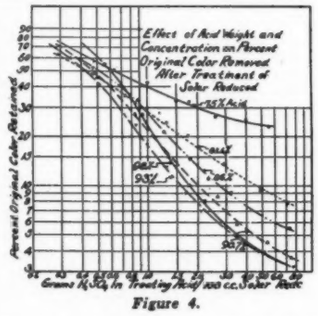

Effect of Acid Weight and Concentration on Percent Original Color Removed After Treatment of Solar Reduced
Percent Original Color Retained
Grams H2SO4 in Treating Acid/100 cc. Solar Reduc

Figure 4.

It should not be understood, however, that 93 per cent acid is the most efficient acid for color removal in all cases. Fluxed bottoms are usually treated much more efficiently with 98 per cent acid. Also, in the case of the treatment of fluxed bottoms the caustic neutralized color is lighter than the ammonia color.

Oil Loss vs. Acid Concentration

The effect of acid concentration on the sour oil loss is shown in Figure 5. This was determined by subtracting the acid volume from the total volume of the sludge at the bottom of the centrifuge tube. The stronger acids are far more drastic in their action on the oil than the weaker. As with color, the initial concentration of the acid, rather than the number of grams of sulphuric acid, is the factor which has greater influence on the yield.

Temperature of Acid Treatment

The effect of temperature on the treatment of solar reduced stock is not very pronounced, except at the lower and higher limits. At lower temperatures the treating efficiency is reduced either by virtue of poor agitation at the high viscosity (1,200 at 60° F.) or by failure to attain equilibrium at that temperature At the higher temperatures, 140° F. or above, oxidation darkens the oil. Between 80° and 115° F. neither the ammonia nor the sour oil color is appreciably changed for any quantity of treating acid up to 15 pounds per 50-gallon barrel. This is borne out by Figure 6 which shows the complete acid-treating curve for several temperature ranges for 93 per cent acid. Similar data were obtained for other concentrations of acid, and all of the curves were of the same general shape, indicating that the treating activity of a weak acid is specific and cannot be increased to equal that of a stronger acid by merely raising the treating temperature.

To determine whether acid is actually less efficient at low temperatures or whether the poorer results mean less effective contact due to high voscosity, a series of tests was made with fluxed solar reduced stock over a temperature range from 32° to 147° F. The results indicate that color removal is improved at the lower temperatures when quantities of acid in excess of 1.5 per cent are employed. This is attributed to a decrease in oxidation. With less than 1.5 per cent acid, the color removal gradually becomes poorer as the temperature and the quantity of acid are decreased. Under these conditions, treating is impaired by virtue of the less fluid sludge. Treating at high temperatures produces the opposite effect. Here the tendency is for the color to increase under all circumstances as the temperature and acid volume increase.

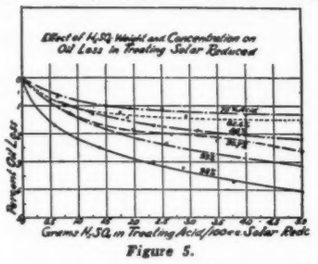

Effect of H2SO4 Weight and Concentration on Oil Loss in Treating Solar Reduced
Percent Oil Loss
Grams H2SO4 in Treating Acid/100cc Solar Redc

Figure 5.

The treatment of naphtha solutions of bottoms and heavy oils is invariably improved by lower temperatures. This follows from the above discussion, as the acid volume in such cases is relatively large.

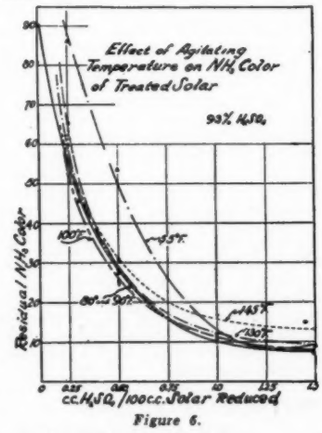
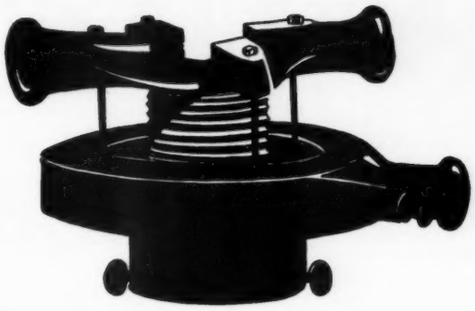


Figure 6.

An important point to note is that the oil loss does not change with temperature, and is no greater at high than at moderate temperatures.

Viscosity, Gravity and Index of Refraction of Treated Oil

The specific gravities of the finished oils produced by treating solar reduced stock with various quantities and con-



PIPE THREADERS

(HAND AND MACHINE)

It is interesting to note that during the first six months of this year, several times as much space was used by manufacturers of pipe threaders in The Oil and Gas Journal as in all other oil field publications put together.

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The Oil and Gas Journal	57
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Third Publication	6
Fourth Publication	0
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centrations of acid were determined with a 10 cc. calibrated picnometer at room temperature and converted to A.P.I. gravity at 60° F. As shown in Figure 7, the first increment of acid produces a marked effect on the gravity. The A.P.I. gravity rises rapidly up to 0.6 per cent acid by volume. With greater volumes of acid, the increase is less pronounced. Stronger acids produce much greater changes in gravity than the weaker acids. This change is a function of the initial concentration of sulphuric acid in the treating acid rather than the grams of sulphuric acid employed. Such great changes in gravity can only be accounted for by the removal of very heavy bituminous

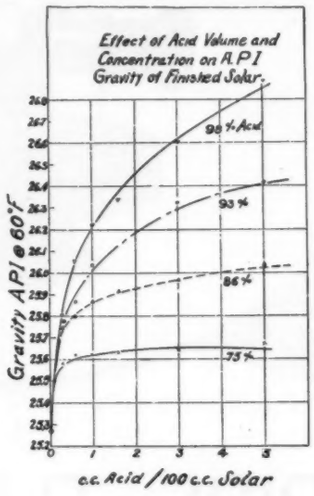
Effect of Acid Volume and Concentration on A.P.I Gravity of Finished Solar.
98 % Acid
93 %
86 %
75 %
Gravity API @ 60°F
c.c. Acid / 100 c.c. Solar

Figure 7.

bodies, and it seems doubtful whether mere polymerization of olefin bodies and their removal could have accomplished this change.

Color removal is not definitely related to the change in gravity (or removal of bituminous bodies); for where the greatest amount of color is removed per unit volume of acid the gravity changes but little (see Figure 8).

Oil loss is definitely related to the change in gravity by virtue of the fact that the gravity change is accomplished by the loss of high density substances from the oil. When the oil loss is plotted against the change in A.P.I. gravity (Figure 9), a straight line is obtained. These curves, however, do not exactly coincide for all acid concentrations, indicating that the material lost is not exactly the same for each acid.

The viscosities of the same finished oils were determined in a pipette viscosimeter. Two determinations were made on each oil, and these were found to check with 0.1 seconds. The viscosity at 100° F. normally decreased as the concentration and quantity of acid increased. This is clearly shown in Figure 10, where the Saybolt viscosity at 100° F. is plotted against acid volume for 98, 93, 86 and 75 per cent acids. Solar reduced stock treated with 75 per cent acid represents an exception to the normal. With this acid, the viscosity first increases 5 seconds at 1.3 per cent acid by volume, and thereafter slowly decreases to 2 seconds below the initial viscosity as a limit.

The viscosity-gravity constant of the treated oil likewise decreased as the concentration and quantity of acid increased, despite the decrease in viscosity. For normal treating conditions, the constant drops from 0.848 to 0.842. This corresponds to a small decrease in the naphthenic character of the oil.

The curve for the index of refraction of the finished oils resembles the density curve, in that the index decreases as the amount and concentration of acid increase, approaching values normally associated with paraffinic oils (Figure 11).

Heat of Acid-Treating Reaction

The heat of the acid-treating reaction of solar reduced stock with various quantities and concentrations of acid was determined in an attempt to correlate color removal with heat of reaction.

The method consisted essentially in measuring the rise in temperature of the stock, previously brought to thermal equilibrium in a thermos bottle, after a definite quantity and concentration of acid had been added. Four hundred grams of oil was placed in a quart thermos bottle provided with a 100° F. viscosimeter thermometer readable to 0.05° F. The thermos bottle containing the oil was shaken in the mechanical shaker, and the temperatures read at intervals of 0, 2, 5, 9, 15, 20 and 25 minutes. The first reading was taken when the oil reached 94° F. and after 25 minutes shaking the temperature rose to 97.4° F. A definite quantity of acid at 98° F. was then quickly added and the shaking continued. Temperature readings were again taken at intervals of 1, 2, 3, 5, 9, 15, 20 and 25 minutes. The thermos bottle was placed in the shaker so that the thermometer was always immersed in the oil, and in taking temperature readings the shaker was stopped for from 3 to 5 seconds. More than 95 per cent of the temperature rise took place in the first minute.

The heat of reaction was calculated by obtaining the temperature rise by plotting temperature as a function of time, and

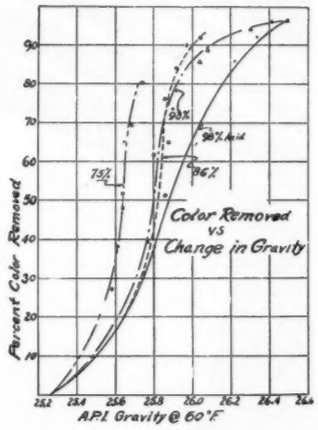

Figure 8.

correcting for the heat of mechanical agitation, the thermal equivalent of the apparatus, and the acid. Figure 12 summarizes the results. It is apparent that the reactions with the various acids differ to a marked degree. When the same data are plotted as a function of color removal, the curves for 75 per cent, 86 per cent and 93 per cent acid almost coincide; while 98 per cent acid stands by itself, higher than the others because of secondary reactions. The extent of coincidence between these curves, however, is not sufficient to conclude that the heat of reaction is a direct function of the amount of color removed. Moreover, the greatest quantity of heat was not liberated when the greatest amount of color was removed.

The heat of dilution of the treating acid undoubtedly plays a part in the total heat of reaction. Calculations based on the assumption that all of the heat was due to dilution showed that excessive dilutions were not required to produce the necessary heat, and it is quite possible that much of the heat may have arisen as a consequence of the dilution of the sulphuric acid by the water produced by the condensation of oxygen bodies.

The oil lost in the treating reaction is a straight line function of the heat of the acid-treating reaction (Figure 13). This follows for all acid concentrations, and treatments having the same oil loss liberate the same amount of heat regardless of the treating-acid concentration.

Acid Consumed in Treating

Contrary to several statements in the literature, the actual acid consumed in treating is not very great. This applies in particular to solar reduced stock. Figure 14 shows the consumption of 93 per cent acid in the treatment of this stock.

In comparing the acid loss with the

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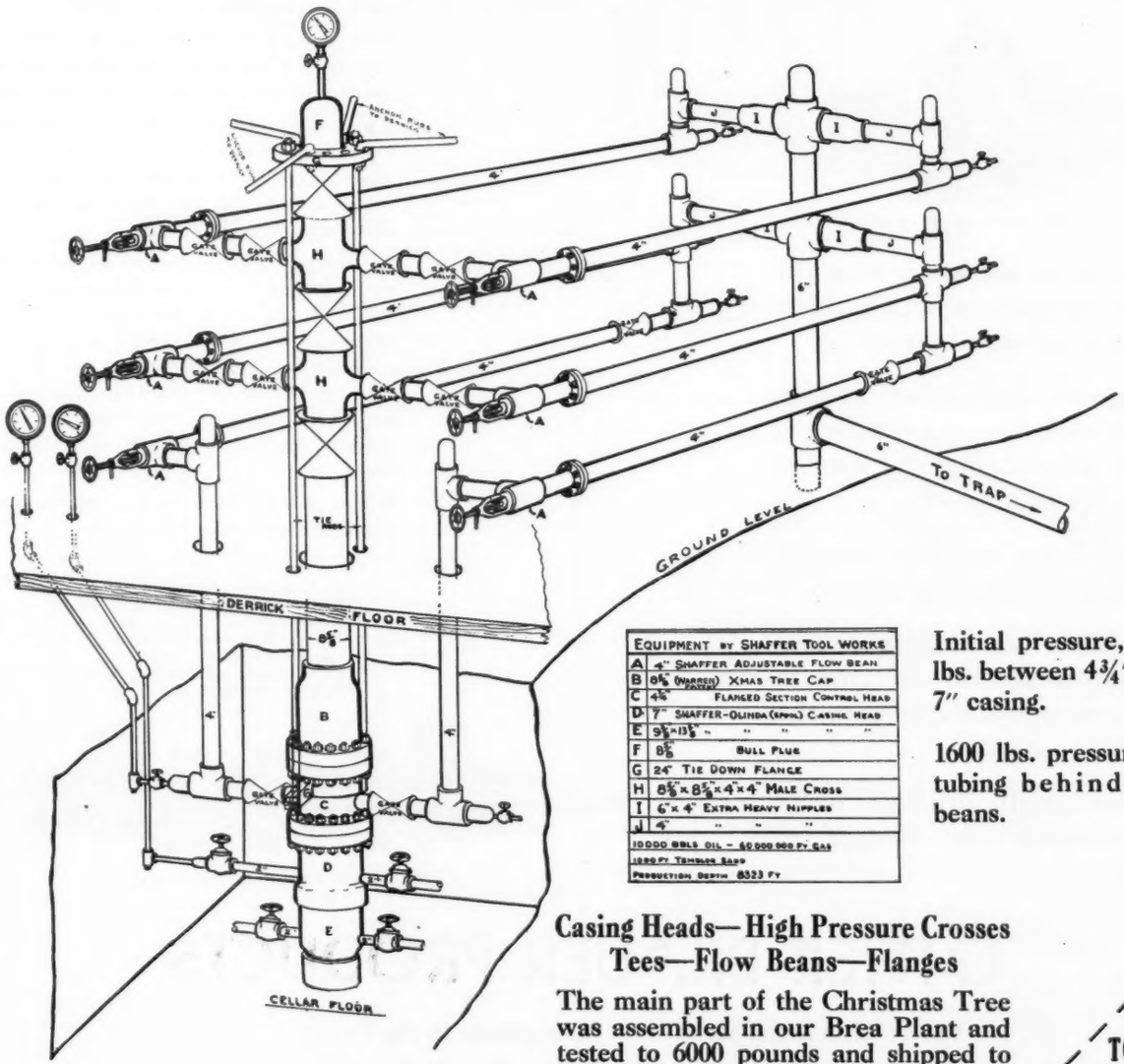

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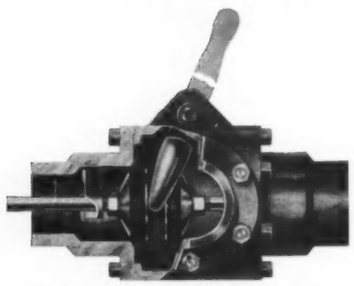

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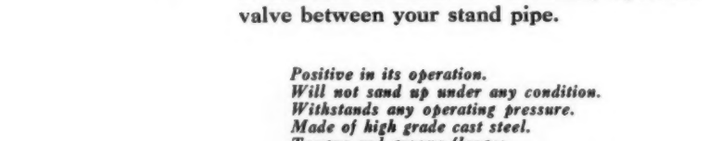

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per cent color removed, we find that more than 92 per cent of the color is removed without an appreciable amount of acid loss (0.1 gram per 100 cc. oil). Further color removal can only be accomplished with a sacrifice of acid. The treating temperature was 95° F.

Part of the loss of sulphuric acid may be attributed to the formation of sulphur dioxide. A series of tests conducted at 95° F. along lines similar to the above showed this to be almost negligible. The per cent sulphuric acid by weight lost as sulphur dioxide varied from 0.06 per cent

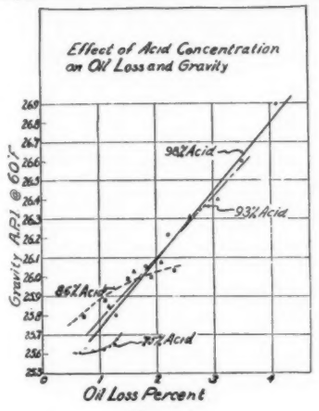

Figure 9.

to 0.22 per cent for tests with 0.25 per cent to 5 per cent acid by volume. Ninety-eight per cent acid produced the greatest amount of sulphur dioxide.

These data were obtained by extracting the acid from the peppered oil with the aid of alcohol, benzine and water. Five extractions usually reduced the acidity to 0.1 per cent of what it had originally been. The inherent error in the procedure was determined by blanks, and the results corrected correspondingly. Quantitative technique and apparatus were employed throughout.

Theory of Acid Treatment

Practically all of the data presented so far have referred to the effect of sulphuric acid applied to solar reduced stock. A considerable quantity of data has been obtained in these laboratories on heavier oils in solutions. The results in general were parallel to those already cited, and justify in our opinion, such conclusions as have already been drawn. In what follows we will mention certain viewpoints which have developed as a result of the work. It should be understood that these conjectures have a different order of reliability than the previous experimental results, but they appear to us to be sufficiently probable to warrant introduction at this time.

It has been said that the acid treating of lubricating stocks is principally a chemical reaction. This statement is based upon the assumption that between 25 and 40 per cent of acid is actually consumed by the reaction with oils and that large volumes of sulphur dioxide are liberated. Furthermore, it is frequently stated that sulphur and oxygen are found to be highly concentrated in the sludges. In distinction to the chemical theory is the physical, or solution, theory, which assumes that the major portion of the action consists in the absorption and subsequent solution of the asphaltic bodies in the acid in exactly the same manner as a soluble substance distributes itself between two immiscible liquids. Another possibility has been mentioned, viz., that bituminous bodies previously retained as (colloidal?) particles in the oil are flocculated by the acid, which thus removes the colored materials.

Judging from the results of this work, we find it difficult to believe that the reaction is largely one in which sulphuric acid is a reactant. The loss of acid in the reaction is insufficient to sustain the chemical theory. Furthermore, the amount of sulphur dioxide liberated represents a negligible part of the total amount employed, and the oil loss is not found to increase with the elevation of the treating temperature.

Every indication shows that chemical reaction with sulphuric acid plays a very minor role. In the work on the heat of the treating reaction, more than 95 per cent of the heat was found to be liberated in the course of one minute. Experimental work showed that at this temperature sulphonation does not take place with such rapidity. It is also improbable that polymerization between olefins promoted by sulphuric acid occurs to any great extent; otherwise the large changes in gravity produced by treating would not have been accomplished. Polymerization between olefins and aromatics seems more plausible.

Solution Theory

The physical, or solution, theory of acid treating is well supported by experimental data. Thus the color removed is less a function of the grams of acid than the concentration and volume. Plotting the per cent color removed against the volume of acid employed for a large variety of oils, the curves will be found to coincide approximately regardless of the color of the stock, provided the same acid concentration is employed throughout. The fact that the treating is enhanced by a lowering of temperature also supports the solution idea.

Several workers have supported the solution theory on the basis of results similar to the color removal curve (Figure 2), which they claim is typical of a solution process. Their contention is probably not well founded, since it can easily be shown that a curve of similar shape might obtain if the process were purely chemical.

What is believed to happen in the treating of lubricating stocks is: First, there is the production of substances having an indicator-like nature which increases the color beyond the stock color.

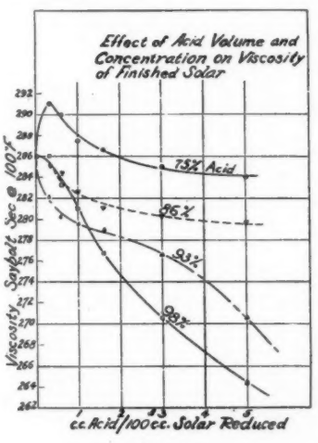

Figure 10.

This is the reactant which becomes yellow in color if the oil is made ammoniacal, and the presence of these bodies accounts for the characteristic maxima on the acid treatment curves previously mentioned. This, we believe, is practically all the "chemical" reaction which occurs, except under conditions discussed under the fourth step below. Second, there is a flocculation of the (colloidally?) dissolved bitumens followed by their absorption by the acid to form a solution or emulsion. Third, color bodies other than bitumens containing chromophore groups are dissolved in the acid by preferential solubility. Fourth, if the quantity and concentration of the acid are high, some sulphonation and oxidation may take place.

If refining is largely a matter of the flocculation of bitumens, it should be possible to return these substances to the main oil body, restoring the oil to its original physical condition. Experiments were conducted to find out whether such was the fact. Samples of solar reduced stock were treated with 0.3 per cent, 0.5 per cent, 1.6 per cent, 2.0 per cent and 3.0 per cent by volume of 93 per cent acid. To these were added alcohol (95 per cent) and benzol is sufficient quantity to dissolve all of the sludge. Each mixture was then neutralized and washed and subjected to distillation at

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350 mm. pressure in order to remove the solvents. The maximum temperature obtained in the distillation was 400° F. A blank was also run (without the addition of acid, but with all other factors the same). Inspection of the acid-treated samples showed that all of the sludge had gone back into solution with the oil. Table 1 summarizes the results.

TABLE 1—RECONSTITUTION OF STOCK FROM TREATED OIL AND SLUDGE

Per cent acid by Vol.	Color	Viscosity* 100° F.	A.P.I.† 60° F.	Index of refraction 20° C.
Virgin Oil	170	286	25.30	1.49937
Blank ...	261	288	25.25	1.49930
0.3	294	297	25.12	1.49945
0.5	306	298	25.15	1.49950
1.0	297	301	25.04	1.49928
1.6	316	299	25.17	1.49930
2.0	348	302	25.07	1.49920
3.0	298	294	25.10	1.49840

*Pipette viscosimeter.
†Picnometer.

Inspection of the table indicates that the order of color change in the blank was the same as that found with the acid-treated samples. It will also be noted that there is no regularity of increase in color with increase in acid applied. Thus, a 3 cc. acid treatment when neutralized according to the above procedure showed almost the same color as a sample given only one-tenth the amount of sulphuric acid. While the results are capable of different interpretation, they

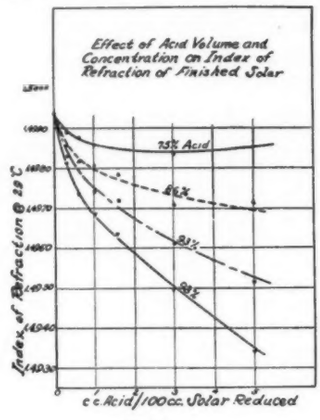
Effect of Acid Volume and Concentration on Index of Refraction of Finished Solar
75% Acid
66°
81°
93°
Index of Refraction @ 20°C
c.c. Acid / 100 cc. Solar Reduced

Figure 11.

present an interesting phenomenon which must be taken into account in any theory of acid treating. It need hardly be stated that the variation in gravity and index of refraction are within the limits of error of determination.

To show further that the oil was not markedly changed in character by the acid treatment and neutralization procedure specified above, the sample which was treated by 1 per cent of acid by volume and "reconstituted" was subsequently treated with an additional 1 per cent in the ordinary manner. This specially treated sample gave a 98 per cent yield of oil having an ammonia true color of 25.6, whereas the virgin oil treated in the identical way gave the same yield and an ammonia true color of 22.2.

Other Applications of Standard Color and Treating Procedure

In concluding this paper in which we have sought to show a certain simplicity and regularity in the reaction of acid on lubricating oils, it may be well to point out certain obvious advantages in this new method of considering acid-treating results. In the first place, it should be mentioned that the procedure has been successfully applied to many different oils. Lack of space has prevented references to a number of interesting relationships discussed in this work. It is clear, for example, that the problem of the economical relationship between acid treating any oil and contact or percolation removal of color with absorbents becomes a matter of simple arithmetic.

Furthermore, since the laboratory work can be done quickly, with excellent reproducibility, and with the highest efficiency of application of the acid, it serves as a true standard of accomplishment for plant operation. It has been shown, for example, in the work of this company that carefully controlled plant operations can very nearly approach the standard set by these treatments of 100 cc. of oil. Failure to accomplish such a result is a clear-cut indication of poor plant operation. Thus, for example, the operation of a large-scale treating equipment was not considered satisfactory until it was capable of approaching the laboratory results as indicated below:

TABLE 2—COMPARISON OF LABORATORY AND SEMIWORKS TREATMENT

Pounds of acid per 50-gal. bbl. of oil	Labor't'ry ammonia Color	Semiworks ammonia Color	Kind of oil
13.0	2.2	2.9	Pressed heavy distillate
7.6	5.0	4.6	Pressed heavy distillate
16.0	12.1	12.5	Solar reduced
8.0	19.5	26.5	Solar reduced
4.0	44.0	54.5	Solar reduced

From results which are not included in this paper, it was possible to decide whether or not two-stage application of acid was justified for this particular installation.

In another instance the procedure was employed to determine the amount of acid required to reduce a long series of overhead lubricating cuts to required color. The decrease in viscosity with treating and other factors of importance at that time were noted to determine the particular distillation column adjustment to produce the most economical cut of high viscosity oil as respects color, viscosity, treating-acid consumption, and over-all viscosity oil yield.

The true color scale adopted in all of the treating work has also been of distinct value in connection with the distillation of heavy oils. Thus the extent by which a particular stock darkens under given distillation conditions is clearly shown by making a color balance involving the yield and color of each of the cuts. From such determinations clean-

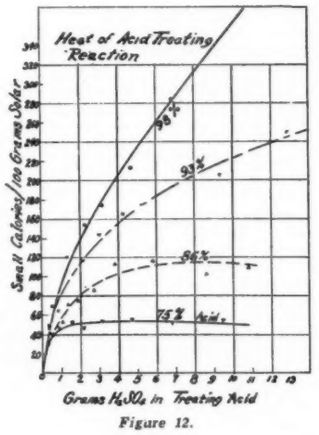

Figure 12.

cut decisions can be made as to whether certain methods of distillation will finally produce improved materials for the acid-treating plant.

It is planned to continue the work, part of which has indeed become routine in connection with our plant operations, in the hope and with the promise that much of the speculation and all of the lore can be removed from the art of acid treating.

Summary

1. A method has been developed which is capable of measuring the color of any oil in terms of true color units. True color units may be expressed in terms of N.P.A. colors.

2. Employing this system of color measurement, a laboratory treating procedure has been developed which has been useful in controlling plant-treating conditions. It enables one quickly to determine for any oil the quantity and concentration of acid necessary to obtain a specified color or oil yield. The samples handled are large enough for complete inspection, and the results are comparable with plant practice.

3. In treating solar reduced stock the first increment of acid produces a sour oil color which is higher than the initial color of the untreated oil. There-

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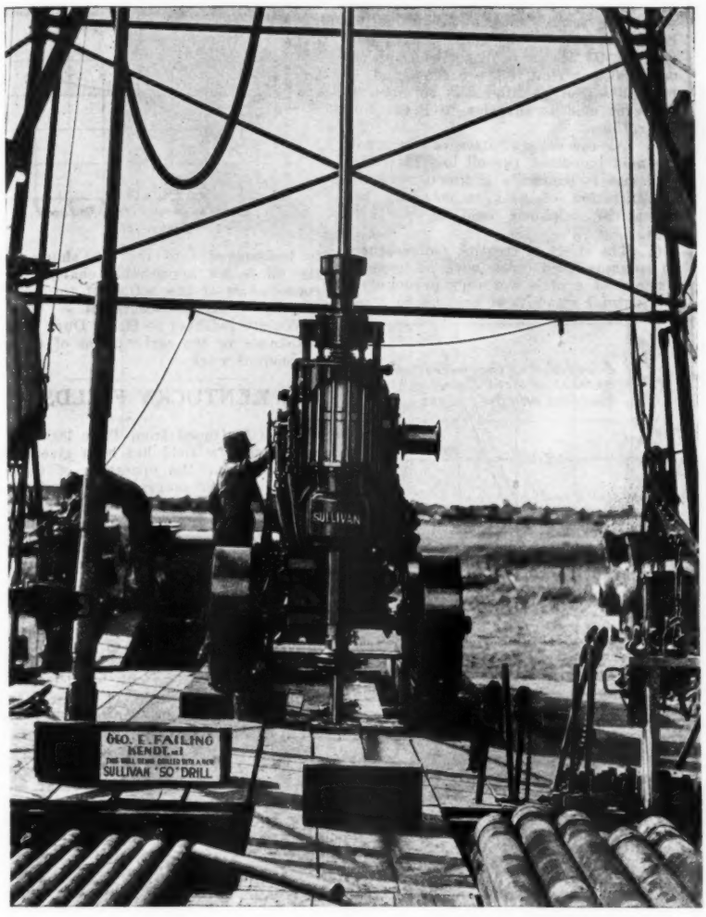

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The Pictures

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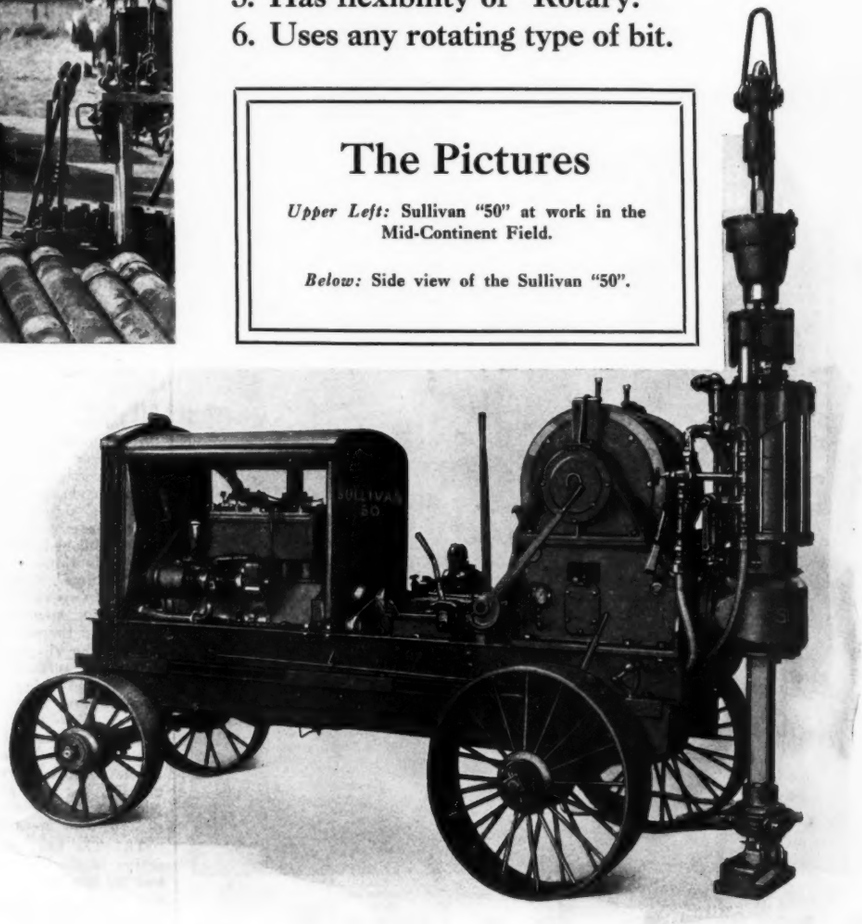
Below: Side view of the Sullivan "50".



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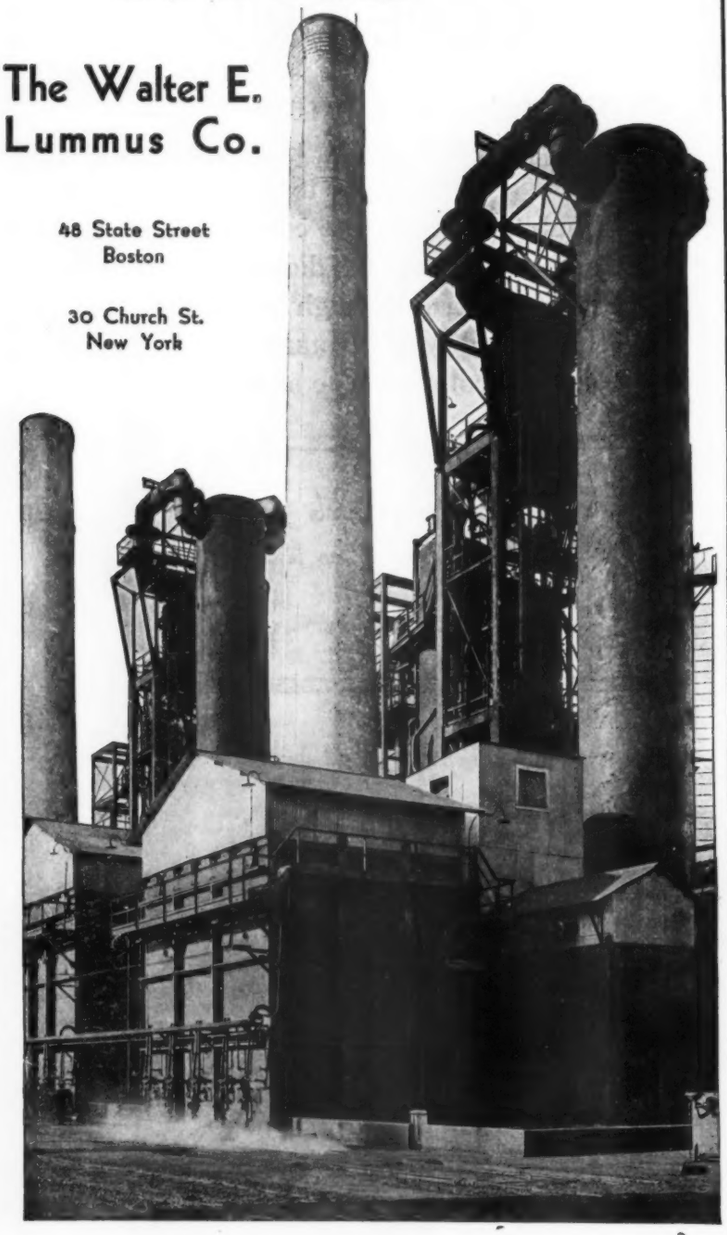


PETROLEUM PLANTS

after the color decreases as more acid is added.

4. On a weight basis, 93 per cent sulphuric acid is superior to 98 per cent as a reagent for the removal of color from solar reduced stock. The sequence of acid concentrations in their order of decreasing efficiencies as reagents for color removal (restricted to solar stock only) is 93 per cent, 98 per cent, 91 per cent, 86 per cent, 83 per cent, and 75 per cent. For naphtha flux bottoms, 98 per cent acid is superior to lower concentrations.

5. As the concentration of the treating acid increases, the oil loss increases. The loss is primarily a function of the concentration of acid rather than the weight of sulphuric acid in the acid used.

6. The effect of treating temperatures on solar reduced stock with all concentrations of acid is not very pronounced. For normal amounts of acid up to 2 per

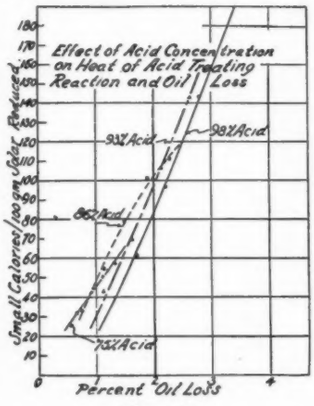

Effect of Acid Concentration on Heat of Acid Treating Reaction and Oil Loss
93% Acid
98% Acid
86% Acid
75% Acid
Small Calories/100 cm Solar Produced
Percent Oil Loss

Figure 13.

cent by volume, the color changes but slightly in the temperature range from 60° F. to 120° F. For volumes of acid in excess of this amount, lower temperatures produce more favorable results, providing the viscosity of the oil is reduced by fluxing with naphtha or water white. The oil loss does not change with variations in temperature.

7. As the volume and concentration of the acid increase, the A.P.I. gravity of the finished solar oil increases. The first increment of acid (up to 1 per cent by volume) produces a proportionately larger increase in A.P.I. gravity than the larger volumes of acid. Stronger acids produce greater changes in gravity than the weaker acids.

8. As the volume and concentration of treating acid increase, the viscosity of the finished solar stock decreases. This change is almost a linear function of the acid volume. The effect of the first increment (up to 0.5 per cent) of 75 per cent acid, however, is to increase the viscosity; thereafter additional acid decreases the viscosity.

9. The refractive indices of finished acid-treated solar oils decrease as the amount and concentration of acid increase.

10. The removal of color with various concentrations of acid does not appear to be definitely related to changes in gravity, for the greatest color removal per unit volume of acid is not accompanied by the greatest change in gravity.

11. The heat of the acid-treating reaction is directly proportional to the oil lost by reaction in the treating, and for any given oil loss the heat of reaction is practically equal for all concentrations of acid.

12. The change in gravity is directly proportional to the oil treating loss, and for any given loss the change in gravity is practically equal for all concentrations of acid.

13. For 95 per cent treating acid, the acid lost or consumed by reaction with solar reduced stock varies from 1 to 3.5 per cent of the initial weight for treatments ranging from 1 per cent to 7 per cent by volume of treating acid. The acid consumed is not proportional to the color removed. The loss due to oxidation, as indicated by the formation of sulphur dioxide, varied from 0.06 per cent to 0.22 per cent for tests with 0.25 per cent to 5 per cent acid by volume.

14. Experiments on the reconstitution of solar reduced stock, whereby sludge

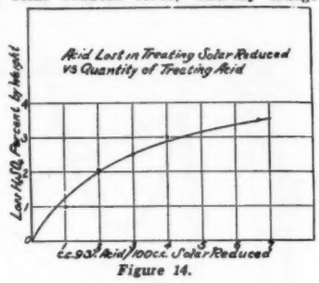

Acid Lost in Treating Solar Reduced vs Quantity of Treating Acid
Lost H2SO4 Percent by Weight
cc. 93% Acid/100 cc. Solar Reduced

Figure 14.

is redissolved into the oil, shows that the oil is not appreciably changed as a consequence of the action of the acid.

Acknowledgement

We are indebted to H. F. Dure for his assistance in the early stages of the experimental work.

KENTUCKY FIELDS

(Continued from Page 90)

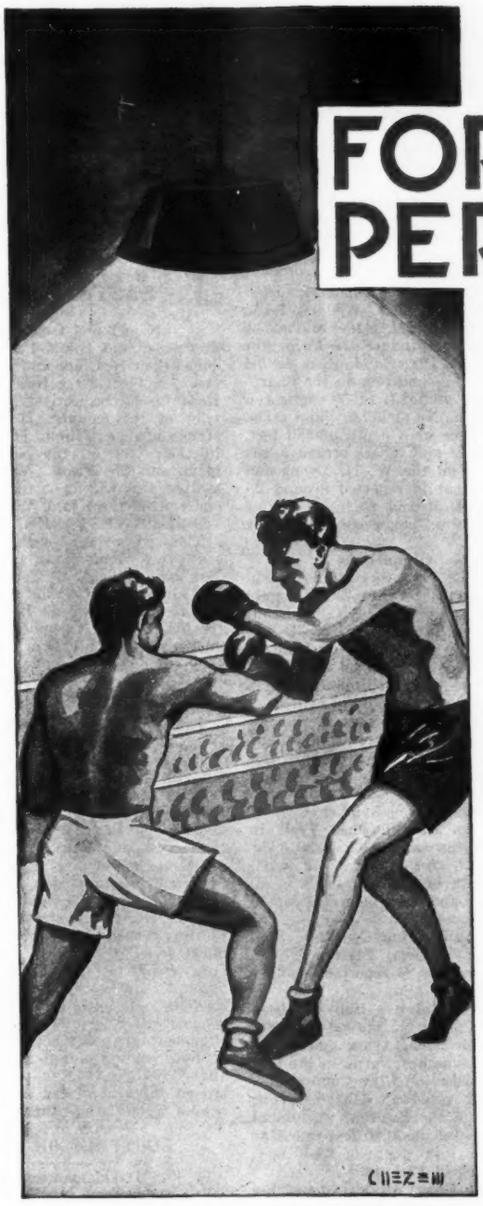
from this new field has been given, and this will spur the operators of Owensboro and other points to try their luck here where their activities are unrestricted. The original discovery well and three offsets are holding up remarkably and the Louis Garvin well, nearly a mile due north, was put on the pump recently and it is thought will yield even better on the jack than it did while flowing. There are at least a dozen rigs running within a radius of a mile of the first well and the extent and capacity of the inside area will be determined within the next couple of weeks. Perhaps never before in Kentucky has such an intensive drilling campaign been started on such a small area and such large sums of money staked on the outcome of a few hundred acres at such shallow depths. Nothing, possibly, could more clearly prove the faith of the Kentucky operator in his favorite sand, the famous Corniferous of Estill and Lee Counties, where it not only proved fabulously productive but its staying qualities endeared it even more, than this push to get acreage as it is claimed by leading geologists to be the Corniferous, the horizon immediately below the base of the Chattanooga shale where the big oil production is found.

There is no topographic map of the country and John H. McClurkin, who is making Horse Cave his headquarters, mapped some 15 square miles with a plane table, locating all farm lines, roads and wells with sea level elevations. The work was done in conjunction with Missouri-Kansas Pipe Line Co. geologists. A new edition of the map will soon be out showing some 35 wells drilling and a more extensive area platted. Dr. W. R. Jillson, state geologist, has two men in the field and a report is expected shortly that should go far towards assisting the operators in future development. Doctor Jillson is authority for the statement that he believes it will prove a great oil field, perhaps of equal importance with the Big Sinking Pool of Lee County.

Among the more prominent operators and companies in the field are the Ohio Oil Co., New Domain Oil & Gas Co., Standard Oil Co. of Kentucky, Wittmer Oil & Gas Co., Rex-Pyramid Oil Co., Interstate Oil & Gas Co., Miller & Damron, Lowman & Daley, Norris Brothers, of Glasgow, George McGinley, H. X. Clark, and many other independent operators.

Ohio County Wells

Quietude still prevails in the Tri-County Field of Ohio, Daviess and Hancock Counties, and will hardly pick up much until the shutdown movement has passed. The Legrande Field in Hart County, which caused a great deal of excitement on the coming in of a few heavy producers, continues to draw the attention of the operators in the Owensboro region, many of them spending their time between the fields, picking up leases and making contracts and locations for drilling. With big gas wells being found in Hart, Green, Barren and adjoining coun-



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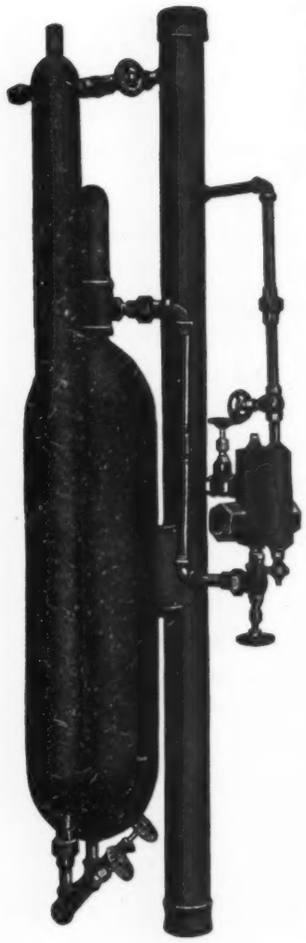

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ties, they have become doubly attractive, the operators say, as the demand for the natural gas, always on the increase, is giving good opportunity for development during the slack time in the crude oil production.

One of the best of the late completions in the Ohio County area was made by the Rex-Pyramid Oil Co. in No. 1 on the W. P. Blair farm, in the Buford Pool, which produced 60 bbls. initial. In the same pool, Leeper Oil Co.'s No. 5 W. Hamilton farm is rated at 50 bbls. initial, while No. 6 is drilling. In the same pool, Chester Oil Co.'s No. 12 W. W. Patton farm produced 30 bbls. the first 24 hours, and Hupp, Duff and others' No. 3 A. French farm pumped 10 bbls., while Smith and others' No. 1 G. T. Taylor farm is reported dry.

In the Taffy area, the Cumberland Petroleum Co.'s No. 3 C. V. Wedding farm, pumped 20 bbls. initial. Rame & Thomas have a 15-bbl. pumper in No. 5 Feemester & Wimsatt farm. Bigler and others drilled a dry hole in a second test on the Sharp-Johnson farm, while J. S. Young got a nice gas well in No. 1 J. A. Sapp farm, in the same area at a depth of 986 feet.

J. R. Pointer and others struck a gas well in No. 2 on the W. H. Lyons and others farm, that is reported around 2,000,000 feet. Hall and Garrison drilled a dry hole on the Tuck Edge farm, same county.

Other Completions

Five miles northwest of Bowling Green, in Warren County, Craft & McDonald drilled a dry hole on the Dr. C. E. Francis farm, at a depth of 515 feet.

In the Pellville Field of Hancock County, D. T. Bolling's No. 3 on the Lewis Richards farm, shows for around 25 bbls. initial.

In the Grindstone Hill area of McLean County, Cameron, Thompson and others' No. 2 is reported good for 100 bbls. initial at 1,088 feet.

Central Gas Corp.'s test on the Mrs. Prior Buchannan farm, 5 miles west of Morganfield, on the Shawnee Trail in Union County, is estimated at 30 bbls. initial where 26 feet of sand was found at a total depth of 576 feet. This is an important test and may mean the opening of a new pool.

Petroleum Exploration Co.'s No. 7 on the Trabue heirs farm, District 17, in Lee-Owsley Counties, is reported good for 10 bbls.

Another important gas find has been made in Bell County, in the eastern part of the State, by T. J. Asher and others on the J. A. Hemminger farm, in the Red Bird section, near the Clay County line, the well being rated at 3,000,000 feet, where the top of the Big lime was found at 2,650 feet and drilled 200 feet into that formation, at a total depth of 2,850 feet.

Field Pickups

The Central Gas Corp.'s test on the Mrs. Prior Buchannan farm in Union County, is the first commercial oil producer that has been found in the county, but showings of both oil and gas have been found in small quantity in other tests. The well was drilled by Contractor E. W. Wilson.

The Missouri-Kansas Pipe Line Co. has completed its pipe line into Greenville, Muhlenberg County, and gas piped in from the gas well on the Parker farm, about a mile south of Greenville, will supply customers at present.

Petroleum Exploration Co. is drilling on the Begley Coal Co. land near Hyden, in Leslie County. Same company is drilling Nos. 8 and 9 on the Trabue heirs, District 17, Lee-Owsley Counties, in Eastern Kentucky.

McLean County is attracting same attention and numerous new locations have been made. Cameron, Thompson and others are starting No. 3 Ed Summers farm, in the Grindstone Hill area. James C. Ellis is starting No. 3 Lila Sandefur farm, same field. Cameron, Thompson and others are also starting No. 2 on the Will Ashton farm. Englow and others are drilling No. 1 Pat Hovver farm, and starting No. 2 same farm. The Ohio Oil Co. is drilling No. 3 G. [illegible] and R. T. Manama farm, also Nos. 2 and 3 on the G. B. and R. L. Manama farm. James C. Ellis is drilling No. 1 Mart Hill farm, and has started No. 2, and the Olean Petroleum Co. is drilling No. 1 Sam Harris farm, and starting No. 2 same farm.

In the Owensboro Field of Daviess County, Doctor Young is drilling No. 1 P. J. Turley farm, and getting ready to start No. 2. Creek Drilling Co. made location for No. 2 John Mills farm, and George Randolph has a location for No. 2 M. E. Cravens farm. Evans and Garrison are drilling No. 1 Dave McGruder farm, and have made location for No. 2.

In Ohio County, B. B. Rhodes is drilling No. 2 J. F. Bruner farm. Oliver Jenkins and others are starting No. 2 M. Hammer farm. Chenault and others are drilling No. 1 Sim Edge farm, and the Cumberland Petroleum Co. is drilling No. 1 Aca Conley farm.

EASTERN FIELDS

(Continued from Page 94)

F. Casper and Hinds Peevey have abandoned their locations and moved their rigs away on the George Reed and Pearlie J. Reed farms, respectively. In Union district of this county, L. C. White and others have a fishing job at 1,100 feet in their test on the Edward Newland farm, and the Frank Webb Oil Co. has located its drilling machine for a second test on the Frank Webb farm.

SOUTHWEST PENNSYLVANIA

There were no wells completed in southwest Pennsylvania. In Harmar Township, Allegheny County, the Chemical Oil & Gas Co. has made a location 600 feet east towards Harmarville from the No. 1 Hugh Campbell, which is producing about 165 bbls. a week and which they completed a couple of months ago.

DRUMRIGHT A.P.I. MEETING

The monthly meeting of the Drumright, Okla., chapter of the American Petroleum Institute Division of Production will be held in their hall at Drumright on the evening of November 18. At that time there will be a number of exhibits on display held over from the October meeting. One of these displays will show a new method of making crankshafts now in use by some of the larger manufacturers of engines. Lantern slides will also be shown illustrating the various four-cycle engines suitable for pumping purposes.

A complete engine, equipped with outer bearings, typical of standard oil field installations will be shown as a demonstration of the latest methods in alignment, giving an actual demonstration of how engines and outer bearings are aligned in the field in order to prevent broken crankshafts and to secure the best results from the operating equipment.

LECTURES ON STEELS

G. Van Dyke, manager of the Special Steels department of Joseph T. Ryerson & Son of Chicago, has been delivering a number of lectures at various points throughout the country on alloy steels, tool steels and stainless steels. The talk gives a general background of the stainless steel alloys and classification of the various analyses, such as high carbon stainless steel, low carbon stainless iron, high chrome stainless iron, chrome nickel stainless iron of the 18-8 type and chrome nickel alloys of the heat resisting type. The various characteristics of these different products are discussed such as corrosion resistance, machinability, formability, weldability, resistance to scaling, etc. A display of samples is shown, including white pickled and polished sheets, cold rolled strips, screws, nuts, wire, samples of deep drawing, polishing, etching, welding and cooking utensils. Further meetings are planned for various principal cities throughout the country, particularly where customers or others interested have asked for meetings.

W. C. ROBINSON DIES

W. Champlin Robinson, for many years prominent in scientific, business and club circles and formerly director of the Federal Commission for Oil Conservation, died in Baltimore November 1 at the age of 57. At the time of his death he was chairman of the board of the United Oil Co.

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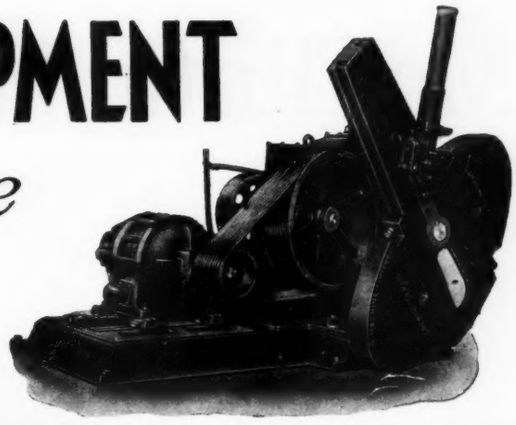

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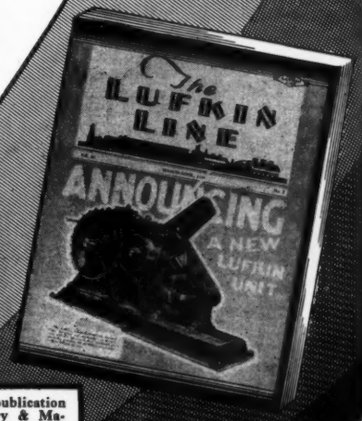

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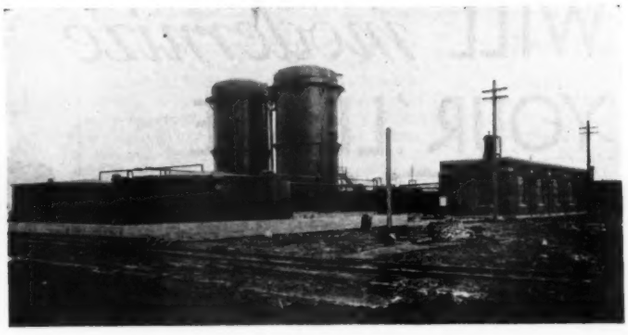
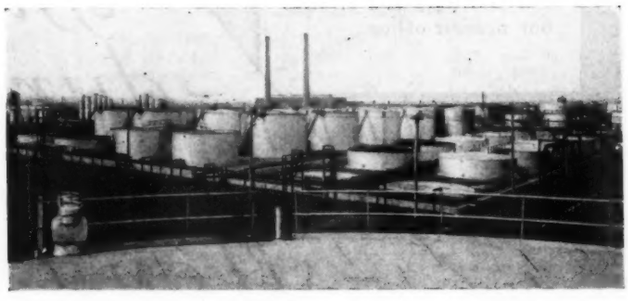


Refinery



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PREDETERMINATION OF SOIL CORROSION

(Continued from Page 159)

inches. Average integrated moisture, 16.0 per cent.

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Month—	Per cent moisture	R_{sp}	Ea	C
January	*25.0	*38	982	*11.0
February	25.8	35	960	12.0
March	25.5	35	840	16.0
April	23.0	32	920	15.0
May	25.5	45	950	10.0
June	16.7	95	821	6.1
July	19.6	80	760	8.0
August	20.0	75	735	9.0
September	25.8	45	950	10.0
October	*19.0	*55	720	*8.0
November	*20.0	*75	722	*9.0
December	*23.0	*32	952	*14.0
Average	25.0			10.7

Notes—*Estimated. Merced heavy clay loam. Soil taken at 24 inches. Yearly rainfall, 5 inches. Average integrated moisture, 25.0 per cent.

Los Medanos Tank Farm

Month—	Per cent moisture	R_{sp}	Ea	C
January	*12.4	*400	840	*1.4
February	12.8	400	840	1.4
March	11.8	420	812	1.4
April	13.3	200	840	2.8
May	13.6	280	830	1.5
June	10.9	450	860	1.2
July	12.3	400	840	1.4
August	12.0	420	770	1.5
September	13.3	210	812	2.8
October	*10.5	*450	860	*1.2
November	*11.5	*420	854	*1.3
December	*12.0	*400	840	*1.4
Average	13.0			1.5

Notes—*Estimated. Antioch clay loam. Soil taken at 24 inches. Yearly rainfall, 10 inches. Average integrated moisture, 13.0 per cent.

Lethent Pump Station

Month—	Per cent moisture	R_{sp}	Ea	C
January	*9.5	*250	650	3.0
February	8.7	200	700	3.5
March	8.0	300	530	2.9
April	7.3	350	595	2.3
May	8.4	290	530	3.0
June	8.0	300	530	2.9
July	6.8	500	600	1.6
August	6.0	600	560	1.4
September	6.6	250	650	3.0
October	*8.5	*220	740	*3.0
November	*8.5	*220	740	*3.0
December	*9.0	*200	700	*3.5
Average	8.0			2.7

Notes—*Estimated. Panoche clay loam. Soil taken at 24 inches. Yearly rainfall, 6 inches. Average integrated moisture, 8.0 per cent.

Corcoran Pump Station

Month—	Per cent moisture	R_{sp}	Ea	C
January	*4.0	*4,000	600	*0.20
February	3.5	4,400	608	0.18
March	3.1	4,200	560	0.20
April	2.0	8,500	635	0.09
May	1.9	9,500	735	0.07
June	6.8	4,000	640	0.19
July	1.4	20,000	600	0.04
August	1.5	18,000	500	0.05
September	5.2	5,000	900	0.10
October	*4.5	*3,600	525	*0.25
November	*4.0	*3,900	542	*0.22
December	*4.2	*3,300	542	*0.24
Average	3.8			0.13

Notes—*Estimated. Foster sandy loam. Soil taken at 24 inches. Yearly rainfall, 5 to 6 inches. Average integrated moisture, 3.8 per cent.

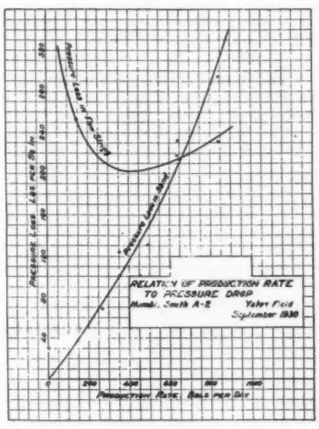
IMPROVEMENT IN PRODUCTION PRACTICE

(Continued from Page 118)

open flow production of a well for a short period of time is dependent, to a great degree, upon the history of the well just prior to taking the open flow test. For this reason, the open flow test is a measure not only of the capacity of the well, but also of the skill of the man in charge of the test. These disadvantages are apparent to many operators, who realize that a satisfactory method of determining potential productions of wells, other than by open flow, would be of great value.

Factors Limiting Production

In order to present the problem more clearly, the factors which limit the potential production of wells should be considered. The energy used in driving oil from the formation to the surface causes pressure losses, which may be divided into two groups: The pressures losses in the sand and the pressure losses in the flow string. The pressure losses in the sand increase steadily with the rate of production, causing the bottom hole pressure to fall off as production rate is increased. In large wells, this decline of bottom hole pressure is comparatively slight, while in the smaller wells it is much greater. The pressure losses in the flow string, however, at comparatively low rates of flow, will decrease as the rate of production increases, due to a reduction in the fraction of the energy lost in slippage. Further increase in production rate will cause increased friction losses, which may reach excessive values, and thus will more than offset



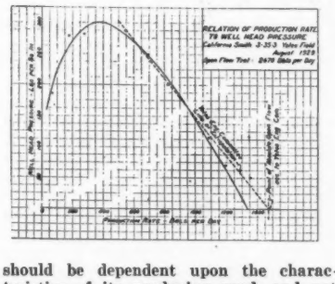
the reduction in slip losses. Thus, the curve of pressure loss in the flow string against production will pass through a distinct minimum. Figure 6 gives the results of a series of tests made on Humble Smith A-2 in the Yates Field, showing the effect of production rate upon the pressure losses in both the sand and flow string. The difference between rock pressure and the sum of the pressure losses in the sand and flow string will give the well head pressure. Figure 7 shows a typical curve of well head pressures plotted against production rate. It becomes apparent that the production rate at zero well head pressure is the true value of the sustained production rate under open flow. This value should not be expected to check the value given by the open flow test.

The Yates Field engineering committee has devoted a great deal of time and energy to the study of the problem of the determination of potential production without open flow. In their report to the Yates Pool advisory committee of December 10, 1929, they recommended that data on well head pressures be taken at various production rates, the results plotted, and the data extrapolated to the point of zero well head pressure by means of a straight line through the points taken at the higher rates of flow. The production corresponding to zero well head pressure is called the point of "absolute open flow." Figure 7 gives an example of this procedure. Although this method has not been adopted in the Yates Pool, it is far superior to the present practice of taking the periodical open flow test. Unquestionably, the data are more accurate than that given by the open flow test. However, it can be shown that the true curve of well head pressures is not a straight line. In some instances the curvature is so marked that serious error may be introduced by the use of a straight line to extrapolate the data. Furthermore, if consistent results are to be obtained, accurate data must be taken over considerable periods of time at high rates of flow. Thus, the dangers of water encroachment are present even in this improved procedure.

Suggested Method

If, in the determination of the relationship between well head pressure and production rate, data on bottom hole pressure are made available, the pressure losses in both the sand and flow string may be plotted, and each of these curves may be extrapolated more accurately than the curve of well head pressures. From these plots, the well head pressure curve can be extrapolated with a greater degree of precision than is possible by the use of the method proposed by the Yates Field engineering committee. Furthermore, by the use of this method, the data taken at the smaller rates of flow, which the Yates Field engineering committee was forced to discard, can be used in estimating the curve of well head pressures. Hence, it is unnecessary to take data at excessively high rates of flow. Thus, it is believed that this proposed method will be of value in determining potential productions more accurately, and with less danger of water encroachment than is possible by the use of either the open flow test or the method of the Yates Field engineering committee.

The previous methods of determining potential productions have all been based on the combined pressure losses in both the sand and the flow string: They have had as their objective the determination of the true production rate which may be sustained under conditions of unrestricted flow. Especially, in the case of larger wells, it is obvious that the nature of the flow string affects very seriously the potential production. Thus, if such a method is employed, wells which, if finished with similar flow strings would have identical production characteristics, may show widely different potential productions because of differences in size of the flow strings with which they are equipped. Hence, those operators who tube their wells, in the interests of gas conservation and production efficiency, find that their potentials are greatly reduced and that, in consequence, they must suffer a serious cut in their allowable productions. The injustice of any system of proration which penalizes the operator for the employment of efficient production practices must be apparent to all concerned. The true size of a well



should be dependent upon the characteristics of its producing sand, and not upon the type of flow string through which the oil is removed from the reservoir. It seems, therefore, that a more equitable system of proration would be based only upon the pressure losses in the sand, disregarding entirely the flow string and the pressure losses therein.

Application of Data

The application of such a method would require data upon the variation of bottom hole pressure with production rate. Several systems for the application of these data to the problem of proration could be developed, three of which will be considered here. The required information has been obtained on two wells in the Yates Field, Humble-Smith A-2 and Humble-Smith A-6. These data are presented graphically in Figure 8, which shows the relationship between pressure loss in the sand and production rate. In order to give concrete examples of the application of the proposed methods, assume it is desired to restrict the production of an imaginary field which contains only two wells whose production characteristics are identical with those of Smith A-2 and A-6. Suppose that it is desired to withdraw 500 bbls. per day from this field, this production to be prorated equitably between the two producing wells on the basis of potential alone. Although in these examples two wells only are considered, the method can be easily extended to include any number of wells.

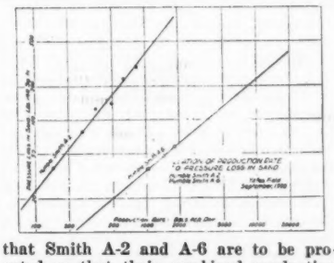
For comparison with the other methods, the allowable productions are assigned to these wells on the basis of an open flow test. Under such tests, Smith A-2 showed a potential production of 1,546 bbls. per day, while the potential of A-6 was found to be 9,090 bbls. per day. The potential of the field is therefore 10,536 bbls.; hence, each well will be allowed 4.70 per cent of its potential. Thus, A-2 may produce 73 bbls. per day, and A-6 may produce 427 bbls. per day.

First System Proposed

The first system of proration proposed for the elimination of the open flow test is one in which potential production would be defined, for the purpose of proration, as that production at which the bottom hole pressure had fallen to a certain value. This value may be taken as the average pressure drop in a certain standard flow string when carrying a quantity of oil and gas, approximately equal to the average open flow production of the field. Suppose this value had been set at 400 pounds. The rock pressure on Smith A-2 is taken to be 700 pounds. Hence the pressure drop in the sand corresponding to the "potential production" is $700 - 400 = 300$. By referring to the curve, Figure 8, the "potential" of A-2 is 820 bbls. per day. Similarly, the rock pressure on A-6 is 670 pounds, and the pressure loss in the sand when the bottom hole pressure had fallen to 400 pounds would be $670 - 400 = 270$. Thus, the potential of A-6 is seen to be 12,500 bbls. A simple calculation will show that if the field is to produce 500 bbls. per day, each well must be rstricted to a production which is 3.75 per cent of its potential. A-2, therefore, may produce 31 bbls. while A-6 may produce 469 bbls. This method is perhaps the simplest of all those proposed to eliminate the open flow test. However, it is believed that modifications of this method may be made which will distribute the allowable production more equitably. For instance, the value of bottom hole pressure used to define potential production could be set at various values for wells of different capacities, in order that the true open flow potential of a well might be more nearly approximated.

Second System

A second system, and one which would probably give a more just distribution of the oil in the reservoir, would set a certain allowable pressure drop in the sand at such a value that when all the wells in the field were producing with this allowable pressure drop, the proration requirements on the field would be met. The exact value of this pressure loss must be determined by trial and error from the data on the individual wells. To illustrate this method, let it be assumed



that Smith A-2 and A-6 are to be prorated so that their combined production is 500 bbls. per day. By successive approximations, it is found that the allowable pressure drop is 17.2 pounds per square inch, that the corresponding production of A-2 is 78 bbls., while that of A-6 is 422 bbls. The great advantage of this system is to be seen in the case of offset wells. If the pressure drop from the property line to the base of the well is the same in each case, the danger of a well draining oil from the adjoining property is minimized. Thus, this system should provide a very satisfactory method of assigning equitable allowable productions to the various wells in a given field.

A system could be developed to encourage operators to employ such means as they could to reduce high gas-oil ratios. Such a system would restrict the production of high gas-oil ratio wells to a greater extent than in the case of the wells producing with low gas-oil ratios.

Summary of Application

The following table presents a summary of the application of three methods

to prorate the hypothetical field under consideration.

	A-2	A-6
Open flow test	73	427
Definition of potential as production at which bottom hole pressure reaches certain value	31	469
Assignment of allowable pressure loss in sand	78	422

The assignment of allowable pressure losses in the sand would probably be the most satisfactory of all the methods considered. The further development of this method to restrict further the production of oil with excessive quantities of gas would be most desirable, inasmuch as it would furnish an incentive to the operators in a given field to use all available means to conserve the formation gas and thus tend to eliminate one of the most vicious of the wasteful production practices which are still prevalent in some fields.

It is hoped that when the inaccuracies and harmful effects of the present open flow tests are realized by the operators in fields wherein production is curtailed, a more rational system of prorating production will be adopted. When the open flow test becomes obsolete, a great step in the direction of conservation of our petroleum resources will have been taken.

ADAPTATION OF GAS LIFT TO SMALL WELLS

By S. F. Shaw
Carter Oil Co.

The use of continuous gas lift reaches an economic limit in small wells, beyond which it is not advantageous to go, by reason of excessive consumption of gas per barrel of oil. This economic limit is reached earlier in the life of wells as the depth increases. It has been found under certain favorable conditions that continuous flow can be replaced by intermittent flow and lifting costs held at a low figure.

Wells with depth of about 4,000 feet require an output of approximately 8,500 feet of gas per barrel of oil when lifting 200 bbls. per day of oil free of water on continuous flow, and an output of 16,000 to 18,000 feet per barrel when producing 100 bbls. per day. The cost for gas at 3½ cents per 1,000 feet is then 30 cents to 60 cents per barrel. These costs are such that it is desirable to make a change in the manner of operating.

Intermittent flowing has been employed for lifting as much as 3,000 bbls. per day from a depth of 4,000 feet, but it is questionable whether this is the best method. When the well has declined to 200 bbls., there is no question as to the desirability of making the change. The general practice in wells making 200 bbls. per day is to admit gas periodically to the same gas line in the well that was employed for continuous flow. Input volumes are reduced to about 4,000 feet per barrel under these conditions. When the well has declined to 100 bbls. or less, it has been found desirable to run two strings of tubing one within the other, the outer string being fitted with a chamber at the bottom with as large a diameter as the casing will admit and provided with a standing valve at the lower end. The oil is flowed intermittently through the inner tubing. With two tubing strings the input factor can vary from 1,500 to 3,000 feet per barrel of oil, resulting in a lifting cost for compressed gas of 5¼ cents to 9 cents per barrel.

Admission of Gas

Admission of gas is controlled by intermitting mechanism, either of the automatic or of the timed interval type.

Wells of 600 feet or more in depth are being successfully flowed intermittently in California. In Seminole at depths of 4,000 to 4,500 feet several wells have been intermittently flowed for periods of a year or more with most encouraging results. A well at Cromwell, with depth of 3,300 feet making 20 bbls. per day, is now being successfully produced by intermittent flow. Other wells near Madison, Kans., at depth of 2,400 feet; and a considerable number of wells near Chelsea, Okla., with depths of 400 feet are being produced by intermittent flowing employing the automatic type of mechanism which is controlled by the height of the fluid level. These shallow wells of 400 feet depth and producing one-half and 2 bbls. per day are probably consuming from 500 to 700 feet per barrel lifted, at a lifting cost for gas between 2 cents to 10 cents per barrel of oil.

L. A. Ogden reported as follows with reference to intermittent gas lift in the Seminole Field, Oklahoma:

"Intermitting came into general use in the Seminole Field in the early part of 1928. Probably the primary purpose back of it was lack of compressor capacity to take care of all the wells without enlarging the 'air lift plants.' It was found that most wells responded favorably to this type of flowing. Below are listed some of the main advantages of intermitting over the straight flow method.

"1. Usually a sustained increase in production results over the straight flow method.

"2. The gas-oil ratio is decreased due to the oil coming out more like a piston with the volume of injected gas not breaking through.

"3. The greater length of time a well can be flowed by this method results in keeping compressors in operation, and gives a combination 'air lift' and gasoline plant a chance to retire its investment.

"4. A saving in compressor capacity is made (e.g.). Two wells on the straight flow require 1,400,000 feet injection per day for each well. It is very possible that the two wells could be flowed with 1,600,000 feet per day making a saving of 1,200,000 feet per day. This is very advantageous where electrical driven compressors are used."

USE OF METERS TO GAUGE FLUID PRODUCTION

By H. A. Brett
Union Oil Co. of California

A new development in lease operations which has taken place during the past year is the use of meters which measure the flow at the well discharging directly into stock tanks, thus eliminating the necessity for gauge tanks.

When selecting a meter for a given well, it is important that sufficient capacity be provided to handle the maximum production from the well in the event that the well produces by heads. A gas eliminator, which is in reality a miniature gas trap, should be set immediately ahead of the meter to insure the delivery of gas-free fluid to the meter; otherwise, the recorded flow will be in error. A by-pass around the meter should be provided so that repairs or replacements may be made without shutting down the well, and a pop valve should also be installed ahead of the meter as a protection against excessive pressure on the lead line and trap in the event that the meter becomes inoperative for any reason or a discharge valve closes in the gathering system.

The chief advantages of the meter installation are the elimination of the first cost and maintenance of gauge tanks without eliminating individual well records, and all the production from one lease is pooled and held in a few tanks located at some convenient point. The number and size of these stock tanks will, of course, depend on the amount of production to be handled and on the shipping facilities. Monetary savings will be directly proportional to the number of wells; the more wells, the greater the saving. Other advantages are the ease of reporting production as the meters are graduated to read in barrels directly; and, because of the pressure of sampling devices with which these meters are equipped, it is possible to obtain a fairly representative lead line sample as a few drops are secured at each pulsation of the meter.

These meters are obtainable, either with or without an automatic device, to compensate for temperature changes, and are known as thermometric or volumetric meters, respectively. Volumetric meters, when adjusted to agree with the gauge tank strapping, have proven entirely satisfactory.

DATA ON LOW TEMPERATURE CRACKING

(Continued from Page 56)

units available per barrel of oil. As a matter of fact, the cracked residues are premium fuels.

The flashed residues had the following properties:

	Oil Source					
	Pennsylvania		Mid-Continent		Mount Pleasant	Refugio
	Kerosene	Gas oil	Fuel oil	Gas oil	Fuel oil	heavy crude oil
A.P.I. Gravity	8.8	9.1	14.9	7.0	11.0	2.0
B.s. and W. %	0.8	0.2	1.1	0.3	0.4	0.3
Furol Vis. @ 122° F.	15	23	29	13	27	157
Cold test °F.	Below 0	Below 0	36	..	Below 0	24

Cracked Gas

The incondensable gas produced from the cracking process has high thermal value and contains from 2 to 3 gallons of motor fuel per 1,000 cubic feet. The thermal values of the cracked gases range from 1,400 to 1,600 B.t.u. per cubic foot.

The following data covers the cubic feet of gas produced per barrel of oil converted and the gasoline content per 1,000 cubic feet produced:

	Oil Source					
	Pennsylvania		Mid-Continent		Mount Pleasant	Refugio
	Kerosene	Gas oil	Fuel oil	Gas oil	Fuel oil	heavy crude oil
Gas (cu. ft. per bbl.)	689	630	362	698	391	604
Gasoline cont. per 1,000 ft.	3 0	2.8	3.2	2.9	2.8	2 1

NORTHERN CALIFORNIA GAS LINE NETWORK

(Continued from Page 88)

of 75 years. That fact, together with the enactment of the California conservation law to prevent natural gas wastage, led Pacific Gas to abandon its plan for supplying mixed gas and to undertake the distribution of straight natural gas.

To insure continuity of supply, laying of a second pipe line was begun. Before work on that line had progressed far, however, the Standard Oil Co. of California and the Pacific Gas & Electric Co. joined forces to build a larger line than had been contemplated so that a sufficient capacity would be available at once in northern California to displace all other fuels.

The second line, known as the Valley Line, is 26 inches in diameter the greater part of its length and was put into operation within nine months after the completion of the first line. The two lines originate at the same compression station near Kettleman and tie together north of Oakland. In addition to the loop formed by the two lines, there is a cross connection, giving the entire project the rough appearance of a figure 8. This construction safeguards the system in case of a break anywhere on the lines. A very small section of the line can be shut off in case of a leak by the operation of valves placed at frequent intervals, and service maintained on the remainder of the lines without interruption.

The gas in the field is under such tremendous pressure that no compressor is required at the intake. The gas is delivered to the line at 500 pounds pressure by the absorption plants of the oil producers. Actual operating tests have proved that the Bay line can deliver approximately 75,000,000 feet daily with a terminal pressure of 50 pounds in San Francisco.

It is estimated that the Valley line will deliver 138,000,000 feet a day under the same conditions, giving a combined capacity of 213,000,000 feet daily, which is sufficient to supply all immediate gas requirements in northern California. To provide for the future growth of the territory, however, plans have been completed for the installation of a compressor station midway of each line at a cost of only $1,500,000, which will increase the capacity of the system to 350,000,000 feet daily.

The entire 750-mile network of transmission pipe lines was completed in the record time of 18 months at a cost of approximately $27,000,000. The company is now busy extending its 6,000-mile distribution system to accommodate growing industrial and domestic demands for natural gas.

CODE COMMITTEE MEMBERS

Additions to the Wisconsin Code of Trade Practices Committee are William McMillan of Lindsay-McMillan Co., Milwaukee, Wis., and F. A. Sheehan of the Winona Oil Co., Winona, Minn.

CALIFORNIA'S REFINED OIL MARKET IS SICKLY

LOS ANGELES, Calif., Nov. 10.—The refined oil market in California showed a weakening tendency during the last week and, although this was not reflected in lower quotations generally, the practice of shading prices was a little more pronounced. The fact remains, however, that in spite of the apparent stabilized market there is an undercurrent of pessimism regarding the maintenance of an economic price structure during the next several months. Conditions on the Pacific Coast are becoming more complex and as time goes on it becomes more obvious that the future price trend depends entirely on the success of curtailment. Some cite the breakdown in the general price structure east of the Rockies as indicative of the futility of attempting to effect stabilization.

Independent refiners are finding their stocks building up with the result that producers are faced with an uncertain market. The major companies are in the position of having to cope with additional production of light crude from Kettleman Hills and Lost Hills-Belridge. The possibility of increased production in these fields is particularly interesting because of the fact that California is faced with an overproduction of natural gasoline so great that if all the natural gas produced next year is treated it will be impossible to cope with the situation.

The tremendous amount of natural gas produced by wells at Kettleman Hills and the probability that further additional quantities will be produced at Lost Hills-Belridge makes the outlook decidedly unfavorable as far as natural gasoline prices are concerned.

DEATH OF C. A. FISHER

Cassius Asa Fisher, internationally known geologist and mining engineer and senior member of Fisher & Lowrie of Denver, died at his home in Denver on November 4 at the age of 58 years. He was a pioneer in the oil industry and in the development of the Salt Creek Field in 1910 to 1913 when that field was discovered. He was the author of several books and bulletins on the coal and oil lands in the United States, Alaska, Central and South America and Europe and was one of the three originators of a method of valuation by the United States Government of coal lands and was co-author of "A Manual for the Oil and Gas Industry," published by the Treasury Department for use in appraising properties for taxation purposes. Recently he was named to the executive committee of the sixteenth international geologic congress which meets in 1932. He was assistant chief of the fuel section of the United States Geological Survey in 1909 and 1910, consulting engineer with the United States Bureau of Mines in 1911 and 1912 and in charge of the United States navy fuel expedition to Alaska in 1912.

REFINERS INCREASE RUNS OF PENNSYLVANIA CRUDE

(Continued from Page 56)

Allegany Fields was increasing more rapidly than the market could absorb it and that some correction must be made. On the basis of 72,000 bbls. consumption and 80,000 bbls. production of Pennsylvania Grade oil, with the Bradford and Allegany Fields producing a total of 43,000 bbls. daily it was felt that a cut of 20 per cent based on April figures would be sufficient to bring supply and demand in balance. This was accomplished during the month of June when these two fields decreased their production approximately 8,000 bbls. daily. However, consumption dropped from 72,000 bbls. in April to 62,000 bbls. in May and 63,000 bbls. in June and it was realized that further steps must be taken. Beginning July 1st, the Bradford and Allegany Fields agreed to curtail their production 50 per cent, based on April figures, and the districts south of Bradford were asked to curtail their production 30 per cent. This resulted in 62,000 bbls. production for the month of July against a consumption of 61,000 bbls. This rate of curtailment with active cooperation of all fields continued until the latter part of September when due to increased consumption which, reflected in August figures of 68,000 bbls., made it possible to lift proration 10 per cent. For the month of August the production was 54,000 bbls. and the consumption 68,000 bbls., according to Bureau of Mines figures and for September the production is estimated at 61,000 bbls. and the consumption 68,000 bbls.

The rate of curtailment now in effect is the same as the month of September, namely, 40 per cent in the Bradford and Allegany Fields and 20 per cent in the area south of Bradford. Further changes will depend on consumption figures.

Pennsylvania Grade Oil Conservation Board

To carry out the conservation plan the Pennsylvania Grade Oil Conservation Board was formed. This board is composed of representatives from each district producing Pennsylvania Grade oil—twenty-two members in all. It meets monthly to discuss production and consumption figures and is a true conservation movement.

In the operation of the Board the paramount consideration is to see that the refiners of Pennsylvania Crude are supplied with an adequate amount of oil. That oil not necessary for current consumption remains in the sand where it can be brought forward as conditions demand and that the supply of such a valuable commodity is not wasted.

Production and Consumption Figures

Previous to January, 1930, the Bureau of Mines production and consumption figures included oil from districts not producing Pennsylvania Grade and it was necessary to make certain deductions from the figures available. The major refining and producing interests had for some time been endeavoring to obtain accurate figures for Pennsylvania Grade only and through the co-operation of the Bureau of Mines this was accomplished during January of this year and from that time the Pennsylvania Grade figures have been considered as an accurate reflection of the condition of the industry.

While these figures are accurate they are available only during the early part of the second month after the period for which the data have been collected. August figures are not published until the early part of October and it was realized that both production and consumption figures must be forthcoming at a much earlier date. It is gratifying to know that this has almost been accomplished.

The American Petroleum Institute is now collecting weekly estimates from the pipe lines purchasing Pennsylvania Grade oil and these estimates are wired to New York each week so they are available for distribution on Wednesday of the following week through the American Petroleum Institute bulletin. Every district producing Pennsylvania Grade oil excepting the middle division is now reporting and it is anticipated that this information will be forthcoming at an early date.

The refining branch of the industry through the National Petroleum Association is collecting weekly figures on runs to stills and these figures are available to that association on Thursday of the week following the actual runs.

With the foregoing arrangement it is now possible to obtain a weekly estimate of both production and consumption and with this information the refiner can be assured of an adequate supply of raw material to suit his fluctuating demands.

Increased Production

Increased production has come through the application of vacuum, air and gas flooding and water flooding. The first two methods are used in the territory south of Bradford while water flooding is used almost exclusively in the Bradford and Allegany Fields. Each has its place and the process used depends upon sand conditions.

The vacuum method has been in use for a number of years and has resulted in an increased production in some territories but the major increase has come through other methods.

Air and gas flooding consists essentially of admitting gas or air to the oil producing sand through means of proper pumping equipment which in turn raises the viscosity of the oil and furnishes the propelling force to remove the oil from the sand.

Water Flooding

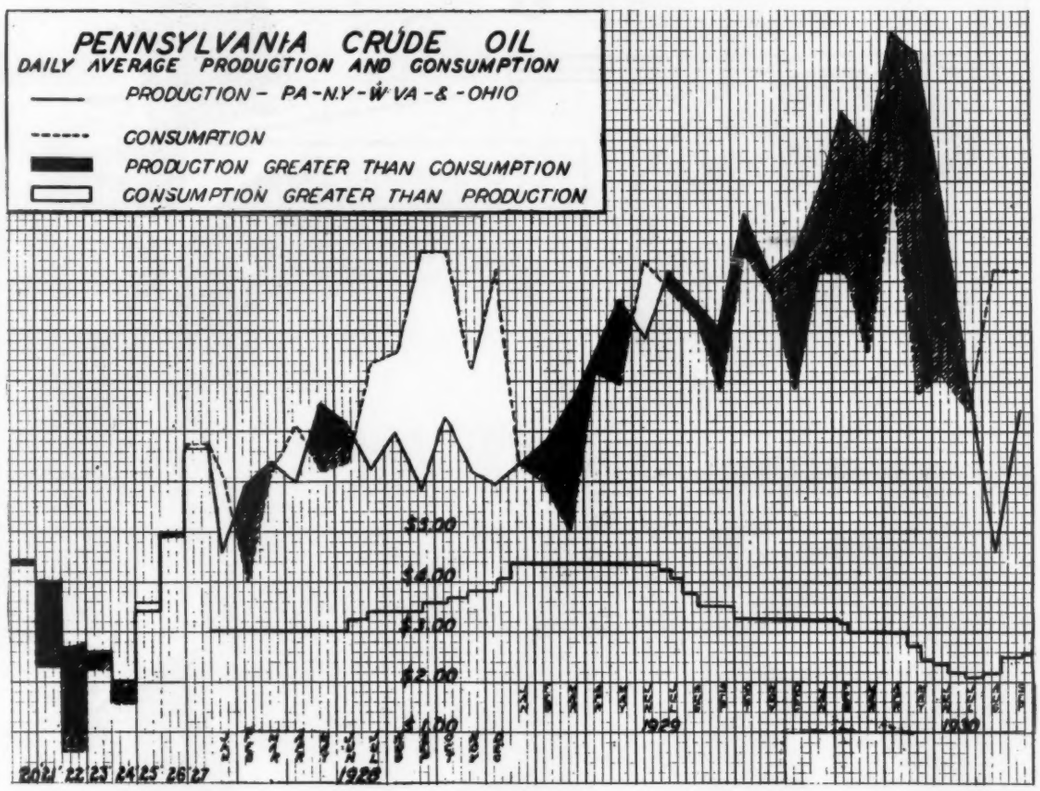
The greatest increase during recent years has come through water flooding and this method applied in the Bradford and Allegany Fields alone will produce an ample supply of crude over a long period. The process has reduced itself to one of mathematics, capital and management.

The process consists of applying water pressure to the oil-producing horizon by means of proper tubing, packers, pipe lines and pumping equipment to water intake wells located in proper relation to the oil wells. The flooding pattern varies somewhat according to the idea of the individual producer but the "five spot" method in which four water wells push against one oil well, or the "seven spot" in which six water wells push against one oil well, are the most accepted patterns at this time.

It is not the intention at this time to enter into a discussion of operating methods excepting to the extent that confidence be established in the ability of the Pennsylvania producers to supply the oil which the market may demand.

By the use of the core barrel operated from the usual cable drilling outfit, it is possible to take samples of the sand from which analyses can be made and the recoverable oil estimated with practical accuracy. The core also furnishes information to govern proper well spacings and the necessary artificial pressure to apply. From production curves the rate which oil can be brought forward has been determined.

A request to the producers today for 5,000 bbls. of oil daily beginning in October, 1931, could be accomplished by drilling 900 acres with a recovery of 5,000 bbls. per acre. At least 40 per cent of this production will come forward in the first year after drilling has been completed which would give a total of 1,800,000 bbls. or the 5,000 bbls. per day requested. During the second year (which would be the first year of production) additional acreage would be developed to take care of the natural decline. This procedure is not a theory but is an established fact.



By the use of delayed pumping a previously determined amount of oil is removed from each well daily. By delayed drilling, through which method the oil is "banked" in the center of the flooding pattern and oil wells drilled only as they are required, a uniform amount of oil can be brought forward daily over the period of depletion. These methods make it unnecessary for the pipe line or refinery to carry excessive stocks.

Increased Consumption

Previous to 1929 a refiner hesitated to expand his markets for fear of an inadequate supply of raw material. Increase in production due to air, gas and water flooding has resulted in a temporary condition where production both actual and potential exceeds consumption. The producing end has gone ahead of consumption but by doing so has firmly demonstrated to the refiner that he can go ahead on a broad marketing basis and expand his business with confidence, knowing that he can obtain the necessary crude supply to take care of his requirements for the next 25 years or more, depending on the rate of depletion. This estimate is based on present production methods, which leave conservatively 50 per cent of the oil in the sand and no doubt improvements in operating technique will lessen this amount.

Additional refineries, unless properly financed and located, will not serve the purpose. They are only of value if supplying a community or area not now being served. The pipe line companies have made their rate so attractive that it is possible to economically transport crude oil over longer distances than heretofore and a refinery can be located in a district serving the greatest number of consumers.

The advertising of Pennsylvania Grade Oil and of 100 per cent Pennsylvania products by the association and the larger marketing companies has resulted in a healthy increase in consumption. This will be further advanced by an increase in advertising assessment to both producers and refiners to further the market of all 100 per cent Pennsylvania products and through advertising campaigns by the major marketers of branded products.

Summary

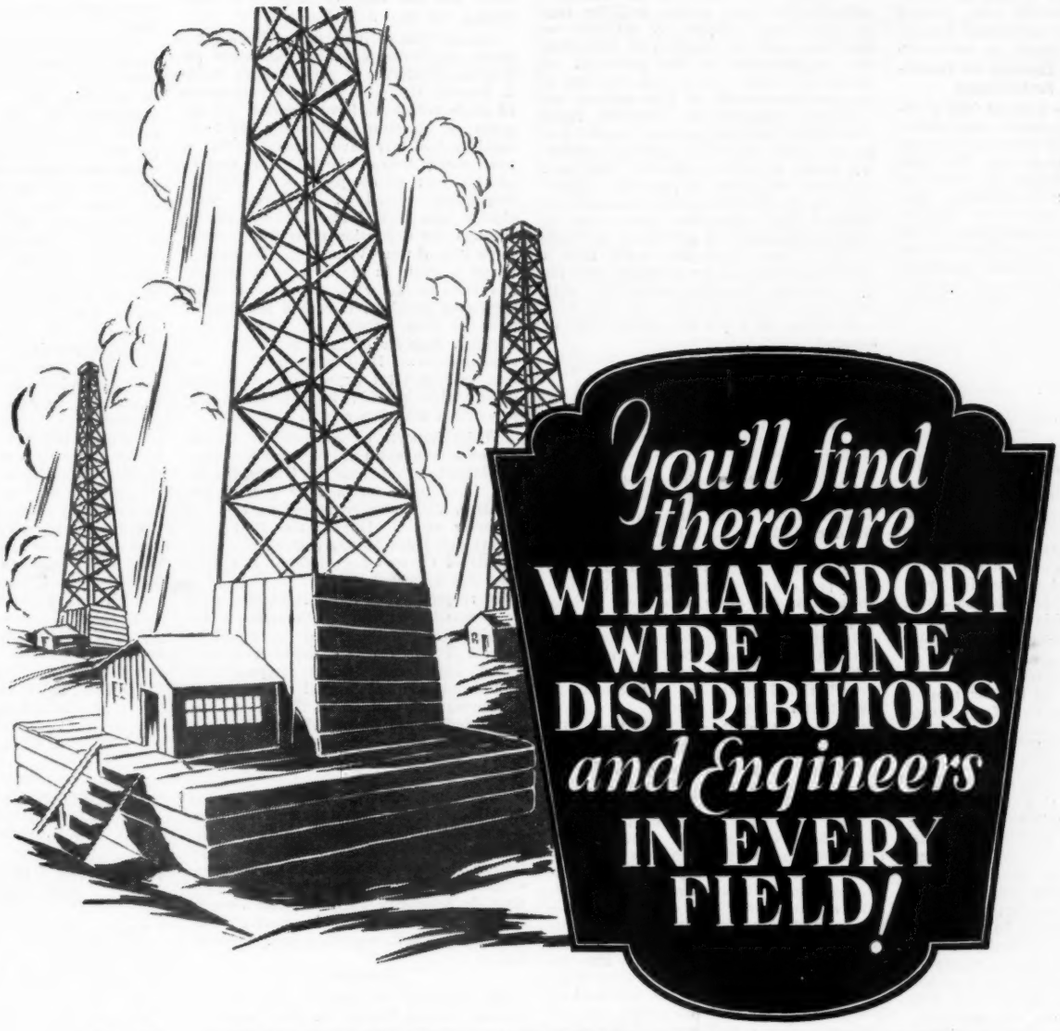
The foregoing indicates that an ample supply of Pennsylvania crude is available at a fair price to the refiners and that the supply will be kept in line with the demand through the operation of the Pennsylvania Grade Oil Conservation Board. Increased consumption will come through an expansion of present markets, additional refineries located at strategic points and new connections with major marketing companies who will use a 100 per cent Pennsylvania product as a complementary line.

GEOLOGISTS TO SAN ANTONIO

The sixteenth annual meeting of the American Association of Petroleum Geologists will be held at San Antonio, Tex., March 19, 20 and 21, 1931. The Gunter Hotel is to be headquarters. The San Antonio section will be the host, with the active co-operation of the San Antonio Chamber of Commerce and the local hotels. Concurrent meetings will be held by the Society of Economic Paleontologists and Mineralogists, a technical division of the A.A.P.G., and by the Society of Petroleum Geophysicists. Special features will be a moving picture lecture by Dr. Laurence Gould, geologist, and second in command of the Byrd South Polar Expedition, and a moving picture presentation of the making of airplane maps for oil companies.

Seen Here and There by The Journal's Cameras

1—R. M. Brown, superintendent, and Frank Neely, general superintendent, Mo ody Superior Oil Corp., Big Spring, Tex. 2—Ward E. Merrick, Merrick & Bristow, Ardmore, Okla. 3—Joe Keevil, Primrose Refining Co., Wichita Falls, Tex. 4—W. D. Latham, drilling superintendent, and E. R. Wimberly, warehouseman, Humble Oil & Refining Co., Van, Tex. 5—J. S. Reid, president, Clark Brothers Co., Olean, N. Y. 6—Jesse L. Bullard, land department, Shell Petroleum Corp., San Antonio, Tex., and president of Southwest Texas Oil Scouts and Land Men's Association. 7—E. E. Finnefrock, manager, Murray Tool & Supply Co., Oklahoma City, Okla. 8—O. D. Williams, drilling superintendent, Helmerich & Payne, Inc. 9—R. T. Todd, Houston representative, and A. E. Raine, Mid-Continent manager, Tulsa, Byron Jackson Co. 10—J. L. Hutchings, Hutchings Non-Freeze Valves, New York, N. Y. 11—A. J. McElvain, representative, Columbian Steel Tank Co., Kansas City, Mo.



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WORKING CHART FOR THE WINTER MONTHS

(Continued from Page 49)

per cent in the gasoline supply from the estimated October rate. Should demand show a decline of 4 per cent, a curtailment of 10 per cent would be required. It is seen further that to gain an inventory position of 40,000,000 bbls., instead of 45,000,000 bbls., an additional curtailment of 2 per cent would be necessary.

Relation of Gasoline Demand to Domestic Crude Oil Requirement

To convert gasoline demand into a domestic crude oil requirement necessitates a consideration of the alternate sources from which gasoline is derived. The gasoline, or motor-fuel supply, is made up of five components: Straightrun gasoline, obtained from crude oil by distillation; cracked gasoline manufactured from gas and fuel oil; natural gasoline extracted from natural gas; imported gasoline; and benzol. The composition of the gasoline supply in September, 1930, was as follows:

Components—	Thous. bbls. dy.	Per cent
Straightrun	607	47.3
Cracked	476	37.1
Natural	142	11.1
Imports	*51	4.0
Benzol	7	0.5
Total	1,283	100.0

*Largely cracked gasoline.

It is seen that less than half the supply of gasoline is derived primarily from crude oil; hence the variations in the other components of gasoline have a profound influence upon the demand for crude oil. Each barrel of gasoline from the other sources replaces 4 bbls. of crude oil. This retationship is of far-reaching importance in the economics of petroleum.

In Table 2 is represented a series of gasoline demands translated into domestic crude oil requirements on the assumption that the other components of the gasoline supply are maintained at the estimated October rate with the entire required adjustment made in straightrun refining. A glance at this table reveals, on the basis shown, that the domestic crude oil requirement will range from 1,910,000 bbls. per day to 2,270,000 bbls. per day, according to the rate of change in gasoline demand. A break-even demand calls for 2,090,000 bbls. daily of domestic crude oil. These figures suggest such a drastic curtailment in crude oil production that it seems desirable to consider whether the other components of gasoline can not be adjusted so that the burden of curtailment would fall less heavily upon the crude oil producer. Cracked gasoline is subject to restriction by the shut down of cracking stills; this adjustment can be made with minimum dislocation to the crude oil situation, but such action is hindered by the competitive sale of antiknock gasoline, whose quality would suffer if the supply of cracked gasoline were curtailed. Natural gasoline is a by-product and its supply is not readily subject to control. Imports of gasoline could be cut down by manufacturing less at the source. Benzol is negligible in volume and may be disregarded. Despite difficulties, all sources of gasoline supply can be reduced, if necessary.

Table 3 shows the effect of varying gasoline demands upon runs to stills and domestic crude oil required, under the assumption that the necessary curtailment of the gasoline supply is applied on the same percentage basis to all sources of gasoline. It may be observed, on this basis, that the break-even demand will exact a reduction (from the estimated October rate) of 4.5 per cent in refinery runs, and a like cutting down (from the October 18 rate) in the domestic output of crude oil. Further, each variation of 1 per cent in the demand factor requires a corresponding adjustment of 1 per cent in the degree of curtailment; that is, if gasoline demand drops an additional 1 per cent, an extra 1 per cent of curtailment will be required; and vice versa. In view of the relationships brought out in Tables 2 and 3, the committee feels that the present emergency calls for a reduction in all sources of gasoline supply, despite the inefficiency of maintaining idle crackers, although a restriction of cracking can be justified only on the basis of expediency.

Allocation of Domestic Crude Oil Requirement

Having calculated a range of domestic crude oil requirements, depending upon the demand for gasoline, the inventory objective for next spring, and the type of curtailment adopted by refiners, we now approach the problem of allocating the requirements to the principal oil producing areas. After consideration of the various aspects of this matter, the committee suggests an allocation based with slight modification upon recent proration schedules in the principal producing areas, on the assumption that such programs represent a practical adjustment in the direction of developing tendencies. This allocation, under varying gasoline demands, is presented in Table 4. It is seen from this table that a break-even demand, for example, calls for the following domestic production, with the figures varying about 1 per cent with each change of 1 per cent in the rate of demand:

	Thousand bbls. daily
California	542
Oklahoma	542
Texas	730
Others	456
Total United States	2,270

The figures shown above and in Table 4 have not been adjusted for overage between October 1 and such time as additional curtailment may be effected. For each month that elapses from October 1, an additional curtailment of approximately 1 per cent will be required to compensate for the overage factor. It may be pointed out, further, that because of their extremely high gasoline content, the Kettleman Hills and Belridge areas of California, if actively produced, will call for additional downward adjustments in allocation figures.

Bearing of Curtailment Upon Fuel Oil

The foregoing analysis indicates that no increase in gasoline demand, under the assumptions previously outlined, calls for domestic runs to stills of 2,310,000 bbls. per day and domestic crude oil production of 2,270,000 bbls. per day. The question arises whether such a schedule will provide sufficient other products. Upon analysis, no deficiencies arise except possibly in the case of fuel oil east of California, and this contingency depends in part upon the extent to which fuel oil demand is adversely affected. Present evidence suggests that refinery runs of 2,310,000 bbls. per day, or less, will lead to heavy drafts on fuel oil stocks east of California, but a deficiency, if it arises, can be made up in several or all of the following ways: By increasing the canal movement from California where stocks are excessive; by reducing cracking further; by running a larger proportion of heavy crudes; by increasing the imports of Venezuelan and Mexican crude and fuel oil; and by decreasing the imports of foreign gasoline.

The committee feels that a sound gasoline schedule should not be permitted to be upset by fuel oil commitments, as a local deficiency of fuel oil would be readily self-corrective.

Check on Supply Through Inventory Control

It is possible to set up a control of supply without estimating in advance the demand for gasoline. This may be done through predetermining monthly inventories that would conform to desired operating schedules and then adjusting supply from time to time in order to hold inventories to the prescribed levels. Table 5 is presented as a suggested course of gasoline and crude oil inventories which would lead to gasoline stocks of 45,000,000 bbls. on March 31, 1931, and no change in crude oil stocks. While the committee favors liquidation of crude oil inventories, which are regarded as far too large, it seems doubtful if liquidation can be accomplished this winter at a time when the seasonal and cyclical factors are both adverse. For the future, however, the committee favors a reduction of crude oil stocks at the rate of 100,000 bbls. daily for an indefinite period; at this rate seven years would be required to cut domestic crude oil stocks in half.

Analysis of the Import Situation

Imports of all oils into the United States are approximately 300,000 bbls per day. This quantity represents about 10 per cent of the total supply of all oils in this country. The trend of imports and the ratio of imports to total supply are shown in Table 6.

An analysis of imports, subdivided into crude petroleum, gasoline, and other petroleum products, is presented in Table 7. During the past three years imports of crude petroleum have declined, but imports of gasoline and other products (mainly fuel oil) have increased. This is particularly true of the first nine months of this year as compared with the corresponding period of last year. This change has been brought about chiefly through the expansion of refinery operations in and near Venezuela. The marked recent increase in the imports of gasoline has been a factor in the general oversupply of gasoline, though a less important one than refinery expansion in this country. Imports of gasoline in the first nine months of 1930 represented 3.8 per cent of our total supply of motor fuel during this period; in September, the proportion was 4 per cent.

While imports of oil into the United States are substantial, they are less than the exports of oil from the United States, and have been for a long period. See Table 8. This country, therefore, is a net exporter of oil. During the first nine months of 1930, 10 per cent of our total supply of oil was imported, while 15 per cent was exported.

In respect to the adjustment of supply to demand over the six months under consideration in this report, it would be helpful if imports of gasoline were curtailed, but a restriction of importations of heavy crude and fuel oil might lead to a shortage of fuel oil in the coastal regions and would impair the gasoline situation if equivalent quantities of fuel oil were obtained by refining higher grade crudes.

The oils imported into the United States are in general lower cost than domestic oils. The primary cause of this difference is that foreign oil fields more largely employ the principles of unit operation with their attendant efficiencies than do American oil fields. One remedy for this condition would be greater progress toward unit operation in this country.

Summary

The demand for gasoline for the six months ending March 31, 1931, can not be closely estimated, but present evidence suggests that it will not exceed a year ago and may even be less. The committee believes that it would be desirable for the industry to adjust its operations to an unchanged gasoline demand as a maximum. The industry is now operating on a basis geared to a 7 per cent increase in gasoline consumption. It is obvious therefore that a substantial reduction in operating rates is called for. A curtailment to balance a break-even demand for gasoline will require a reduction of 7 per cent from the estimated October rate of gasoline supply, if gasoline inventories next spring are not to exceed 45,000,000 bbls.

If a reduction of 7 per cent in the supply of gasoline is spread on an even percentage basis over the various sources of gasoline, then a crude-run-to-stills of 2,310,000 bbls. per day and a domestic crude oil production of 2,270,000 bbls. per day are indicated. Should gasoline demand prove more adverse or refiners confine their gasoline curtailment to straightrun operations, additional restriction of refinery runs and crude oil production would be called for and tables are presented to cover these contingencies. If, on the other hand, demand should turn out to be more favorable, then the inventory situation may be permitted the benefit. A domestic crude oil production of 2,270,000 bbls. per day, corrected for estimated overage to date, becomes 2,240,000 bbls. per day and the latter figure may be allocated as follows (or other quotas in proportion): California, 535,000 bbls.; Oklahoma, 535,000 bbls.; Texas, 719,000 bbls.; and all other states, 451,000 bbls. A method of inventory control of gasoline is presented which may be used as an operating guide without predetermination of the demand for gasoline. The import situation is analyzed and it is shown that while imports of crude petroleum have decreased, receipts of gasoline and fuel oil from abroad have increased; and that while 10 per cent of our total supply of oil is imported, 15 per cent is exported.

Respectfully submitted,
COMMITTEE ON PETROLEUM ECONOMICS,
J. Elmer Thomas, Chairman (in absentia).
Joseph E. Pogue, Acting Chairman and Secretary.
Ray M. Collins.
H. W. Lowrie, Jr.
H. P. Grimm.

WILLIAM PIEZ DIES IN BRUSSELS, BELGIUM

William Piez, European correspondent of Link-Belt Co., and a brother of Charles Piez, chairman of the board, Link-Belt Co., died at Brussels, Belgium, on November 2 after a week's illness.

William Piez, previous to his association with Link-Belt Co., was district manager of the Concrete Steel Co., Chicago. Since 1928 he lived at Paris, France, where he was European correspondent of Link-Belt Co. He was born at Newark, N. J., in 1878.

WILDCAT OPERATIONS IN WEST TEXAS

(Continued from Page 81)

H. F. Wurtz' No. 1 E. A. Ibbetson et al, 330 ft. from N and E lines of NW, Sec. 16, Blk. 46, Twp. 3s, G. M. M.Br.&A. Sur. ..... Drlg. 3,001 ft.

Skelly Oil Co. and Republic Prod. Co.'s No. 1 McKenzie, 990 ft. from S line and 330 ft. from E line of Sec. 28, Blk. 45, Twp. 2s, T.&P. Sur. ..... Shut down 3,750 ft.; flowed 110 bbls. on July 12, shut in for storage.

Southern Crude Oil Pur. Co.'s No. 2 Cowder & Co., 660 ft. from S and W of NE cor. Sec. 34, Blk. 43, Twp. 1n, T.P. Sur. ..... Location.

The Texas Company's No. 9 Connell, 330 ft. from N and 440 ft. from W of SE cor. Sec. 1, Public School Land.. Drlg. 3,590 ft.; top pay 3,535-40 ft.; flowing 18 bbls. at each head every 4 hours.

EL PASO COUNTY

Lane-The Texas Company's No. 1 Malone, 2,110 ft. from SW and NW of Section 46, J. M. Day Sur. ..... Shut down 3,089 ft.

FISHER COUNTY

Condor Pet. Co.'s No. 1 Wilson, 330 ft. from N and 1,200 ft. from W, Sec. 6, W. E. Richardson Sur. ..... Drlg. 1,250 ft.

Cranfill & Reynolds' No. 2 Flannigan, 330 ft. from S and E of W half of Section 200, B.B.B.&C. Sur. ..... Shut down 3,130 ft.

Cranfill & Reynolds' No. 3 Willingham, 330 ft. from S and E of Sec. 307, B.B.B.&C. Sur. ..... Shut down 3,090 ft.

The Texas Company's No. 2-A Stephens, 330 ft. from S and E, Sec. 79, Blk. 1, H.&T.C. Sur. ..... Drlg. 1,300 ft.

The Texas Company's No. 1-B Teagarden, 1,990 ft. from S and 440 ft. from E, Sec. 3, W. F. Richardson Sur... Drlg. 1,800 ft.

GAINES COUNTY

Texas Consolidated Oil Co. et al's No. 1 Jones, 2,310 ft. from NE, Sec. 4, Blk. A-3, P.S.L. Sur. ..... Bldg. standard rig.

GARZA COUNTY

Pandem Oil Corp.'s No. 1 Justice, 330 ft. from S and W of Sec. 13, Blk. 4, H.&G.N. Sur. ..... Spudded and shut down.

GLASSCOCK COUNTY

F. H. E. Oil Co.'s No. 1 Meek, 1,650 ft. N and E parallel to section lines of SW cor. Sec. 7, Blk. 34, Twp. 3s, T.&P. Sur. — Drlg. 650 ft.

Timberlake & Snyder's No. 1 Meek, 2,310 ft. W and 1,600 ft. N of SE cor. Sec. 7, Blk. 34, Twp. 3s, T.&P. Sur. — Total depth 2,956 ft.; shut down.

World Oil Co.'s No. 3-C McDowell, 2,310 ft. from S and W of NE cor. Sec. 21, Blk. 34, Twp. 2s, T.&P. Sur. — Shut down 660 ft.

HOWARD COUNTY

Cosden Oil Co.'s No. 6 Roberts-A, 200 ft. N and E of SW cor. Sec. 129, Blk. 29, W.&N.W. Sur. — Sulphur water 1,433-46 ft.; shut down 1,456 ft.

G. F. Getty's No. 1 Snyder, Sec. 27, Blk. 10, Twp. 1s, SW cor. of NE of NE — Drlg. 2,465 ft.

Greene O. & R. Co. et al's No. 1 Denman, 330 ft. from N and W of E half of NE, Sec. 14, Blk. 30, Twp. 1s, T.&P. Sur. — Pumped 62½ bbls. first 14 hours Oct. 31; total depth 2,780 ft.

Magnolia Pet. Co.'s No. 1 Kelley Roberts, 330 ft. S and E, Sec. 112, Blk. 29, W.&N.W. Sur. — Bldg. standard rig.

Merriwether's No. 1 Smith, 150 ft. from S, 2,400 ft. from W, Sec. 45, Blk. 33 — 2,000 ft. water in hole; shut down 3,270 ft.; 3,000 ft. sulphur water in hole; will abandon.

Moody Oil Corp.'s No. 23-B Roberts, 990 ft. from N and W of Sec. 137, Blk. 29 — Shut down 261 ft.

HUDSPETH COUNTY

Theison's No. 1 University, 2,050 ft. from S and 2,225 ft. from E of Sec. 17, Blk. E — Spudded 35 ft. and shut down.

Western States Oil Co.'s No. 1 Gardner & Moseley, NE NW Sec. 12, Blk. 18 — Shut down 3,155 ft.

IRION COUNTY

Bristow et al's No. 1 Nutt, 180 ft. from NW of SW of NW Sec. 6, Gonzales County School Land — Total depth 1,735 ft.; plugged back to 1,458 ft.; preparing to put on pump.

Central Oil Co.'s No. 2 Horney, 150 ft. from N and 1,320 ft. from E, Sec. 3, Blk. 3, H.&T.C. Sur. — Drlg. 700 ft.

Cromwell et al's No. 3 Tankersley, 150 ft. from N and 210 ft. from W of E half of Sec. 1,320, G.C.&S.F. Sur. — Shut down 1,712 ft.; show oil 1,631-35 ft.

Straughn & Texannati Oil Co.'s No. 1 Tankersley, 150 ft. from S and 750 ft. from W of Sec. 4, Gonzales County School Land — Shut down 1,321 ft.; oil sand 1,230-25 ft.; filled up 200 ft. in 12 hours.

Williams & Williams' No. 1 Noelke, 200 ft. from N and 1,020 ft. from E, Sec. 8, City of San Antonio Sur. — Shut down 1,995 ft.

F. F. Webb's No. 1 W. H. Williams, 200 ft. from E and 750 ft. from S line, SW of NE Sec. 10, Gonzales County School Land — Shut down 100 ft.

JONES COUNTY

McBest et al's No. 1 Roberts — Total depth 1,000 ft.

Pope et al's No. 1 Swann, 2,023 ft. from S and 400 ft. from E of I. Miley Sur. No. 381 — Total depth 2,535 ft.; swabbed 84 bbls. oil on 24-hour test; top pay 2,516-34 ft.

S. C. Yingling et al's No. 1 Cade, 330 ft. from N and W from SE cor. of NW of Sec. 17, Blk. 19, T.P. Sur. — Location.

LOVING COUNTY

Arkansas Fuel Oil Co.'s No. 1 Dean, 990 ft. from NE and 2,310 ft. from SE, Sec. 84, Blk. 1, W.&N.W. Sur. — Drlg. 4,125 ft.

Eppenauer et al's No. 1 Allen, 2,310 ft. from NE and NW lines, Sec. 90, Blk. 1, W.&N.W. Sur. — Drlg. 2,923 ft.

Henshaw et al's No. 2 Reagan & McElwain, 1,650 ft. from SW and 990 ft. from SE, Sec. 84, Blk. 7, W.&N.W. Sur. — Rig.

Lockhart & Co.'s No. 3 Bowen & Wells, 330 ft. from NE and SE of Sec. 92, Blk. 1, W.&N.W. Sur. — Shut down 3,383 ft.

Independent O. & G. Co.'s No. 2 Wheat, 990 ft. from NW and 330 ft. from SW, Sec. 85, Blk. 1, W.&N.W. Sur. — Shut dow 2,835 ft.

Lockhart & Co.'s No. 2 fee, 676 ft. S, 330 ft. W, Sec. 91, Blk. 1, W.&N.W. Sur. — Spudded 140 ft.; shut down.

Lockhart & Co.'s No. 3 Hubbard, 1,650 ft. from NE line, 330 ft. NW line of Sec. 83, Blk. 33, H.&T.C. Sur. — Rigged up and shut down.

Miller et al's No. 1 Chapman, 225 ft. from NW and 285 ft. from SW line, Sec. 71, Blk. 1, W.&N.W. Sur. — Drlg. 4,070 ft.

Rush et al's No. 1 Wheat, 330 ft. from NW and SW, Sec. 77, Blk. 1, W.&N.W. Sur. — Cellar.

Slagel Drlg. Co.'s No. 1 Cartwright et al, 2,310 ft. from S and 990 ft. from W, Sec. 1, Blk. 57, Twp. 1, T.&P. Sur. — Rig up.

California Co.'s No. 5 Reagan & McElvain, 990 ft. from NW and 330 ft. from NE of Sec. 84, Blk. 1, W.&N.W. Sur. — Drlg. 1,600 ft.

California Co.'s No. 6 Reagan & McElvain, 330 ft. from SW and 1,650 ft. from SE, Sec. 84, Blk. 1, W.&N.W. Sur. — Drlg. 510 ft.

MENARD COUNTY

Barnett et al's No. 3 Callan City Co., 330 ft. from S and W, Sec. 1, B.S.&F. Sur. — Shut down 1,814½ ft.

Barnett et al's No. 4 Callan City Co., 1,200 ft. from S and 2,200 ft. from W, Sec. 1, B.S.&F. Sur. — Machine.

Panhandle Ref. Co.'s No. 2 Eckhart, 1,820 ft. from W and 1,320 ft. from S of Sec. 10, Blk. 2, T.W.N.G. Sur. — 500,000 ft. gas with show oil 2,945 ft.; shut down 3,200 ft.; to plug back to 2,955 ft. to save gas.

Priest's No. 1 Sorrell, 1,000 ft. from E and 200 ft. from S cor. Sec. 132, E.L.R.R. Sur. — Shut down 2,490 ft.

MIDLAND COUNTY

Kerwin et al's No. 1 Mathen, 2,310 ft. from N and 335 ft. from W line, Sec. 40, W. L. Gray Sur. — Drlg. 2,140 ft.

MITCHELL COUNTY

Morrison et al's No. 2 Morrison, 2,390 ft. from N and 660 ft. from E of Sec. 31, Blk. 28, Twp. 1n, T.&P. Sur. — Shut down 3,112 ft.; top pay 3,038-75 ft.; shot 270 qts. 3,020-92 ft.; swabbed 40 bbls. in 24 hours.

Morrison et al's No. 1 Poe et al, 660 ft. S and 1,980 ft. W, parallel to section lines of NE cor. Sec. 8, Blk. 27, T.&P. Sur. — Spudded 10 ft. and shut down.

PECOS COUNTY

Bell et al's No. 1 Eaton, 2,310 ft. from NE and 990 ft. from SE, Sec. 33, Blk. 3, H.&T.C. Sur. — Location.

Bell et al's No. 1 Schaff & Blackman, 2,310 ft. NE and 330 ft. NW of E cor. Sec. 37, Blk. 3, H.&T.C. Sur., but located in Sec. 38, Blk. 3, H.&T.C. Sur. — Drlg. 885 ft.

Dittman's No. 1 Jackson, 2,310 ft. from NE and 330 ft. from NW, Sec. 28, Blk. 3, H.&T.C. Sur. — Moving in machine.

Dittman's No. 2 Eaton, 990 ft. from SW and 330 ft. from SE, Sec. 35, Blk. 3, H.&T.C. Sur. — Location.

Dittman's No. 1 Eaton, 330 ft. from NE and SE, Sec. 37, Blk. 3, H.&T.C. Sur. — Location.

Humble Oil & Ref. Co.'s No. 1 Kokernot, 1,320 ft. from N line and 1,467 ft. from W line of Sec. 227, Blk. 10, G.H.&S.A. Sur. — Drlg. 5,883 ft.

Humble Oil & Ref. Co.'s No. 1-B Thoman, 1,608 ft. from N and 4,062 ft. from E of Sec. 98, Blk. OW, G.C.&S.F. Sur. — Drlg. 2,800 ft.

Lewis & Slagel's No. 1 Bell, 330 ft. from N and W of SE Sec. 12, Blk. 30, Twp. 1s, T.&P. Sur. — Location.

McCurdy & Brown's No. 2 Tippett, 150 ft. from N and W of SE, Sec. 40, Blk. 194, G.C.&S.F. Sur. — Location.

McCarty Oil Co.'s No. 2 Gray, 700 ft. from N and 2,260 ft. from W, Sec. 591, G.C.&S.F. Sur. — Drlg. 525 ft.

Messenger et al's No. 1 Butz, 1,830 ft. from NW and 1,119 ft. from SW, Sec. 54, Blk. 10, H.&G.N. Sur. — Fishing 1,105 ft.

J. R. Miller et al's No. 1 Bennett, 309 ft. W of CWL Sec. 1, Blk. 119, G.C.&S.F. Sur. — Shut down 1,700 ft.

J. D. O'Mara's No. 1 Bennett, Sec. 593, 1,460 ft. from S 150 ft. from E, G.C.&S.F. Sur. — Total depth 1,230 ft.; top pay 1,089 ft.; plugged back to 1,185 ft.; will drill deeper.

J. D. O'Mara's No. 1 Streety, S of Sec. 1, W. P. Howard Sur. — Shut down 2,210 ft.; fishing.

Oregon Oil Corp.'s No. 2 Yates, 150 ft. from S and W of Sec. 58, Blk. 1, I.&G.N. Sur. — Shut down 2,440 ft.; flowing sulphur water.

Perren Oil Co.'s No. 2 Eaton, C of E of W, Sec. 27, Blk. 3, H.&T.C. Sur. — Fishing 1,765 ft.

Plymouth Oil Co.'s No. 1 Gerry, 330 ft. from N and W, Sec. 13, Blk. 194, G.C.&S.F. Sur. — Total depth 1,920 ft.; top pay 1,892 ft.; flowing 25 bbls. per day.

R. W. Porpus et al's No. 1 State Land, 330 ft. S and W lines of NE, Sec. 28, Blk. OW, T.C. Sur. — Spudded and shut down.

Pure Oil Co.'s No. 1 Harrison, 2,310 ft. from N and 330 ft. from W of Sec. 203, Blk. 3, T.&P. Sur. — Drlg. 4,019 ft.

Riser & White's No. 1 Riser, 2,297 ft. from S and 997 ft. from E of Sec. 24, Blk. 12, H.&G.N. Sur. — Shut down 405 ft.

Side & Side's No. 1 Blackstone & Slaughter, C NW of Sec. 34, Blk. A-2, T.C. Sur. — Shut down 2,605 ft.

Schilling & Slaughter's No. 1 Yates, 1,580 ft. N and 150 ft. E of NW cor. Runnels County School Land, but located in Sec. 70, Blk. 1, I.&G.N. Sur. — Shut down 357 ft.

California Co. et al's No. 1 Thomas, 990 ft. from NW and SW, Sec. 31, Blk. 34, H.&T.C. Sur. — Location.

The Texas Company's No. 1 Wright, 660 ft. S and E of NW cor. Sec. 9, Blk. 131, T.&St.L. Sur. — Shut down 3,504 ft.

Warner's No. 1 Webb, 2,550 ft. from NW and 6,100 ft. from NE of Sec. 311, Abst. 756, C. McGinley Sur. — Drlg. 1,885 ft.

Williams & Moran's No. 1 Heiner Est., 450 ft. from N and 2,490 ft. from W of Sec. 590, G.C.&S.F. Sur. — Shut down 765 ft.

REAGAN COUNTY

Big Lake Oil Co.'s No. 5-C University, 625 ft. from S and 900 ft. from W of Sec. 25, Blk. 9 — Drlg. 6,780 ft.

Slick Estate et al's No. 1 August, C SE Sec. 1,216, G.C.&S.F. Sur. — Drlg. 250 ft.

Texon O. & L. Co.'s No. 4-B University, 1,130 ft. from N and W of Sec. 26, Blk. 9 — Shut down 5,300 ft.

REEVES COUNTY

R. T. Hansford's No. 1 Williams, 150 ft. from S and W, Sec. 17, Blk. 6, H.&G.N. Sur. — Shut down 380 ft.

Black & Kink's No. 1 Brooks, 1,980 ft. N and 660 ft. W, Sec. 16, Blk. 50 — Top pay 1,820 ft.; shot 15 qts. 1,821-30 ft.; shut down 1,860 ft.

Riggs & Smith's No. 1 Lee Monroe, 2,390 ft. from NE and 330 ft. from NW line, Sec. 34, Blk. 8, H.&L.N. Sur. — Shut down 176 ft.

Salsbury & Gregory's No. 1 Young Bell, 1,170 ft. from N and 330 ft. from NW line, Sec. 34, Blk. 7, H.&L.N. — Temporarily abandoned.

Lee O. White et al's No. 1 Hershersor, 330 ft. from N and W lines of Sec. 5, Blk. 51, Twp. 10, T.&P. Sur. — Shut down 4,415 ft.

California Co.'s No. 1 Kloh & Rumsey, 1,650 ft. from S and E of Sec. 13, Blk. 54, Twp. 4, T.&P. Sur. — Total depth 4,264 ft.; plugged back to 4,244 ft.; shot 150 qts. 4,202-40 ft.; hole full salt water after shot; now cleaning out.

RUNNELS COUNTY

Dutton et al's No. 1 Dean, 5,475 ft. from NE and 1,048 ft. from NW in J. Heil Sur. No. 419 — Fishing for bailer 1,695 ft.

George W. Boyce's No. 1 Lang, 2,310 ft. N, 6,900 ft. E Sec. 262 — Show oil 2,028 ft.; shut down 2,643 ft.

SCHLEICHER COUNTY

Delmar Oil Co.'s No. 1 O'Harrow, C of NW Sec. 56, Blk. 1, G.H.&S.A. Sur. — Fishing 5,577 ft.

Teas & Gant's No. 1 Allison, 1,320 ft. N and E of SW cor. of Sec. 37, Blk. K, G.H.&S.A. Sur. — Shut down 3,960 ft.

Wesner et al's No. 1 Nicks, 2,310 ft. from N and 2,362 ft. from E of Sec. 77, Blk. LL, T.C. Sur. — Shut down 750 ft.

Westyde et al's No. 1 Meador, 1,320 ft. from S and E of Sec. 661, G.C.&S.F. Sur. — Location.

George Wilson's No. 1 Page, Sec. 40, Blk. L, 1,390 ft. from N, 1,470 ft. from W, G.H.&S.A. Sur. — Shut down 5,027 ft.

SCURRY COUNTY

Byrd & Harmon's No. 1 Murphy, Jr., 320 ft. from N and E of Sec. 114, Blk. 97, H.&T.C. Sur. — Top pay 1,750 ft.; show oil 2,812-55 ft.; shot 150 qts. 3,100-35 ft.; pumped 55 bbls. 24 hrs.; total depth 3,501 ft.

Camp Spring Oil Co.'s No. 1 Strayhorn, 330 ft. from S and 1,980 ft. from W of Sec. 154, Blk. 3, H.&G.N. Sur. — Drlg. 700 ft.

I. D. Mimms et al's No. 1 J. J. Koonsman, Sec. 216, Blk. 2, H.&T.C. Sur. — Shut down 4,573 ft.

G. E. Dickman and R. B. Pender et al's No. 1 F. C. Davis, 1,000 ft. N and 1,770 ft. W of SE cor. of Sec. 275, Blk. 2, H.&T.C. Sur. — Shut down 4,970 ft.

Seifert & Dibble's No. 1 T. M. Blackburn, 2,310 ft. from N and 2,310 ft. from W line of Sec. 155, Blk. 97, H.&T.C. Sur. — Drlg. 375 ft.

Mid-Kansas O. & G. Co.'s No. 1 Peckham, 330 ft. from S and W of R. N. Miller Sur. — Underreaming 4,373 ft.

STERLING COUNTY

Beesley et al's No. 1 Foster, 2,940 ft. N and 300 ft. W of SW cor. Sec. 7, Blk. 22, H.&T.C. Sur., but in Sec. 16, Blk. 21, Twp. 4s, T.&P. Sur. — Shut down 515 ft.

SUTTON COUNTY

Independent Oil & Gas Co.'s No. 1 Wilson, Sec. 30, Blk. A, 1,650 ft. from N, 2,310 ft. from W. — Location.

TAYLOR COUNTY

Adams et al's No. 2 Lowe, 150 ft. from N and 750 ft. from W. Sec. 19, Guadalupe County School Land. — Drlg. 2,435 ft.; est. 1,000,000 ft. gas 2,301 ft.

Eastland Oil Co. et al's No. 2 Hunter, 3,418 ft. from S and 2,174 ft. from E of William R. Ellis Sur. — Drlg. 1,540 ft.

John B. Jameson's No. 1 Webb, 1,170 ft. S and W of NE cor. Sec. 46, Lunatic Asylum Land — Drlg. 6,230 ft.

Hucony Oil Co. et al's No. 1 Richie, C SE Sec. 10, Blk. A, S.P. Sur. — Shut down 2,570 ft.

Sanger et al's No. 1 City of Abilene, 830 ft. from S and 1,400 ft. from E of Sec. 66, Blind Asylum Land. — Drlg. 1,260 ft.

Sanger O. & R. Co.'s No. 1 Osborn, 330 ft. from SW of SE Sec. 68, Blind Asylum Land — Rigged up and shut down.

TERRELL COUNTY

Big Bend Oil Co.'s No. 1 Bassett, C NW Sec. 155, Blk. D, M.-K.-T. Sur. — Drlg. 2,660 ft.

Keck Pecos Trust Co.'s No. 1 Hamilton, C Sec. 6, Georgetown Ry. Sur. — Shut down 3,150 ft.

Milham Corp. of Texas' No. 1 R. M. Bassett et al, 150 ft. from N line and 2,640 ft. from E and W lines of Sec. 78, Blk. Y, James Bass Sur. — Location.

Miller Bros.' No. 1 Allison & Burke, C NW cor. Sec. 10, Blk. 176, T.&P. Sur. — Shut down 120 ft.

Mrs. J. B. McPhees' No. 1 Sam Belt, C Sec. 16, Blk. D-7, E. L. Sur. — Shut down 880 ft.; moved off machine.

Transcontinental Oil Co.'s No. 1 Goode, 2,152 ft. from E and 330 ft. from S, Sec. 26, Blk. 161, G.C.&S.F. — Drlg. out cement 4,730 ft.; total depth 5,229 ft.

Woodley & Jones' No. 1 Pankenham, C SE NW Sec. 43, Blk. B-2, C.C.S.D.&N.G. Sur. — Shut down 640 ft.

TOM GREEN COUNTY

Belding & Dutton's No. 1 Norsworthy, 2,640 ft. from S and 587 ft. from E of John McNeese Sur. ..... Shut down 760 ft.; show oil and gas 725 ft.

Cosden Oil Co.'s No. 1 William Anson, 2,310 ft. S, 330 ft. W of NE cor. Sec. 30, Blk. 24, H.&T.C. Sur. ..... Location.

Fitzgerald & Taliaferro's No. 1 Bennett, C SW Sec. 1,626, E. H. Dinger Sur. ..... Plugged back to 2,405 ft. to straighten hole; shut down 2,447 ft.

Mintex Oil Co.'s No. 1 Campbell Est., 446 ft. from S and 630 ft. from W of Sec. 180, Dist. No. 11, S.P. Sur.... Shut down 1,835 ft.

Phillips Pet. Corp.'s No. 1 Guiden, 1,250 ft. from N and 1,583 ft. W of Sec. 77, James Webb Sur. ..... Drlg. 4,995 ft.

UPTON COUNTY

Duffey et al's No. 2 McClintic, 328 ft. N and 967 ft. E of Sec. 206, Blk. F, C.C.S.D.&R.G.N.G. Sur. ..... Drlg. 1,400 ft.

Gulf Prod. Co.'s No. 1 King Ranch Oil & Lignite Co., 330 ft. from S and 990 ft. from W line, Sec. 28, Blk. 2, M.-K.-T. Sur. ..... Total depth 2,753 ft.; pumped 20-bbls. in four hours.

T. P. Coal & Oil Co.'s No. 1 King Ranch Oil & Lignite Co., 3,310 ft. from N and 990 ft. from W, Sec. 28, Blk. 2, M.-K.-T. Sur. ..... Rig up.

Weekly Oil Corp.'s No. 1 Shirk, 468 ft. from S and 2,317 ft. from E, Sec. 15, Blk. 3, M.-K.-T. Sur. ..... Drlg. 725 ft.

VAL VERDE COUNTY

Independent Operators' No. 1 Whitehead, SE SE Sec. 30, Blk. 4, I.&G.N. Sur., elev. 1,175 ft. ..... Shut down 5,360 ft.

O. O. Owen's No. 1 Mills, Sec. 125, Blk. 1, I.&G.N. Sur., elev. 2,130 ft. ..... Fishing 6,780 ft.

Phantom Oil Co.'s No. 1 Ingram, 175 ft. W of E line and 300 ft. N of S line, Sec. 33, Blk. D-8, E.L. Sur. ..... Shut down 3,035 ft.

Valvert Oil Corp.'s No. 1 Bassett, C NE Sec. 47, Blk. Y.. Shut down 4,009 ft.

WARD COUNTY

Alpine Oil Co.'s No. 2 Boogher, 2,200 ft. from NW and 1,800 ft. from SW lines, Sec. 11, Blk. 5, H.&T.C. Sur... Running 8¼-in. casing 780 ft.

Empire Gas & Fuel Oil Co.'s No. 1 John Sealy estate, 330 ft. from S and 1,650 ft. W of NE cor., Section 5, Blk. F, T.&M.M. Bros. Sur. ..... Location.

Gulf Prod. Co.'s No. 3 Wristen Bros., 220 ft. NE of SW and 220 ft. SE of NW Sec. 18, Blk. 5, H.&T.C. Sur.... Show gas 1,960-70 ft.; filling up with sulphur water 2,520-77 ft.; salt water 2,545 ft.; plugged back to 2,477 ft.

Magnolia Pet. Co.'s No. 1 Sealy, 330 ft. from S and E of NE cor. Sec. 46, Blk. 2, G.M.M.B.&A. Sur..... Drlg. 3,041 ft.; show gas 3,016 ft.; 500 ft. oil in hole; top pay 3,036 ft.

R. F. Owens' No. 1 Johnson, 100 ft. from NE and 1,100 ft. from SE of Sec. 8, Blk. 33, H.&T.C. Sur. ..... Shut down 1,200 ft.

Richardson et al's No. 5 O'Brien et al, 330 ft. from N and 2,970 ft. from W of Sec. 5, Blk. F, G.M.M.B.&A. Sur. ..... Drlg. 2,470 ft.

Rickford & Smith's No. 1 Johnson, 120 ft. NE and 175 ft. SE of N cor. Sec. 7, Blk. 32, H.&T.C. Sur., but located in Sec. 11, Blk. 5, H.&T.C. Sur. ..... Drlg. 296 ft.

California Co. et al's No. 1 Lanham, 990 ft. from NE and SE, Sec. 35, Blk. 34, H.&T.C. Sur. ..... Building rig.

T. P. Coal & Oil Co.'s No. 1 James, 330 ft. from SW and SE, Sec. 5, Blk. 34, H.&T.C. Sur. ..... Location.

Shipley et al's No. 5 Hayzlett, assume common line Secs. 16 and 17 is N and S, 220 ft. S and 1,910 ft. W, Sec. 17, Blk. 5 ..... Standard rig.

Shipley et al's No. 1 Monroe, 330 ft. SE SW Sec. 3, Blk. 1 ..... Shut down 2,520 ft.

T. P. Coal & Oil Co.'s No. 1 Barker, 330 ft. from SW and NW of Sec. 27, Blk. B-29, Public School 'Land..... Total depth 2,425 ft.; pulling tubing to cement 6⅝-in. casing.

California Co.'s No. 1 Allen, 2,310 ft. from NE and 330 ft. from SE, Sec. 30, Blk. 34, H.&T.C. Sur. ..... Drlg. plug 55 ft.

WINKLER COUNTY

Empire Gas & Fuel Co.'s No. 1-C Daugherty, 990 ft. from S and 2,310 ft. from E, Sec. 16, Blk. 74, Public School Land ..... Show oil and gas 2,800-14 ft. and 2,816-20 ft.; est. 1,000,000 ft. gas; preparing to drill ahead 3,065 ft.

Magnolia Pet. Co.'s No. 1 Bashara, 1,650 ft. from S and 2,310 ft. from W, Sec. 17, B-3, P.S.L. Sur. ..... Drlg. 155 ft.

Magnolia Pet. Co.'s No. 3 Scarborough, 1,650 ft. from N and 990 ft. from W of Sec. 1, Blk. 77, Public School Land ..... Drlg. 2,790 ft.

A. W. Phillips' No. 2 Brown et al, 2,000 ft. S and W of NE Sec. 4, Blk. B-5, Public School Land ..... Shut down 3,120 ft.

Liner Drlg. Co.'s No. 1 Campbell, 330 ft. from N and E cor. Sec. 2, Blk. B-5 ..... Shut down 4,639 ft.

Turman et al's No. 1 Daugherty, 2,310 ft. from E and 2,310 ft. from S line, Sec. 16, Blk. 74, Public School Land ..... Drlg. 2,765 ft.

WILDCAT OPERATIONS IN TEXAS PANHANDLE

(Continued from Page 82)

Kewanee O. & G. Co.'s No. 2 Arnold, 330 ft. N and E, SE, Sec. 149, Blk. 3, I.&G.N. Sur. ..... T.D. 3,257 ft; T.P. 3,185 ft; shot with 140 qts. 3,185-3,252 ft; swbd. 38 bbls. in 2 hrs.

Danciger O. & R. Co.'s No. 1 Sullivan, 231 ft. N, 224 ft. W, of E 160 ac. of S 264 ac., N½, Sec. 136, Blk. 3, H.&G.N. Sur. ..... Drlg. 550 ft.

Danciger O. & R. Co.'s No. 2 Sullivan, 231 ft. N, 884 ft. W, of E 160 ac. of S 264 ac., N½, Sec. 136, Blk. 3, H.&G.N. Sur. ..... Drlg. 530 ft.

Dulaney & Word's No. 1 Morse, 330 ft. S and W, Sec. 18, Blk. A-9, H.&G.N. Sur. ..... Drlg. 2,090 ft.

Empire G. & F. Co.'s No. 2-B Archer, 330 ft. S and E, SW, Sec. 139, Blk. 3, I.&G.N. Sur. ..... T.D. 3,240 ft; shot 120 qts. from 3,175-3,210 ft; C.O.

Empire G. & F. Co.'s No. 1 Bell, 1,320 ft. S, 1,660 ft. E, SW, Sec. 111, Blk. 3, I.&G.N. Sur. ..... Drlg. 1,110 ft.

Empire G. & F. Co.'s No. 1 Cantrell, 330 ft. S and E, Sec. 136, Blk. 3, I.&G.N. Sur. ..... Standardizing 2,397 ft.

Empire G. & F. Co.'s No. 1 Froshier, 1,320 ft. S and E, Sec. 177, Blk. 3, I.&G.N. Sur. ..... Drlg. 1,780 ft.

Empire G. & F. Co.'s No. 1 Sullivan, 330 ft. NW of E 64 ac. of W 104 ac. of S 264 ac., N½, Sec. 136, Blk. 3, I.&G.N. Sur. ..... Drlg. 2,950 ft; 1,000,000 ft. gas 2,-775 ft.

Empire G. & F. Co.'s No. 2 Sailor, 330 ft. N and W, NE, Sec. 138, Blk. 3, I.&G.N. Sur. ..... C.O. 3,230 ft.

Jean Pet. Co.'s No. 1 Furneaux Bros., 330 ft. N and W, cor. SE, Sec. 200, Blk. B-2, H.&G.N. Sur. ..... S.D. 2,765 ft.

Magnolia Pet. Co.'s No. 1 Latham, 376 ft. N, 150 ft. E, Sec. 153, Blk. 3, I.&G.N. Sur. ..... Standardizing 2,600 ft.

Magnolia Pet. Co.'s No. 2 Heithold, 150 ft. S, 1,156 ft. W, SE, Sec. 152, Blk. 3, I.&G.N. Sur. ..... Rig.

Magnolia Pet. Co.'s No. 2 Latham, 175 ft. N, 150 ft. E, Sec. 153, Blk. 3, I.&G.N. Sur. ..... Drlg. 2,050 ft.

Magnolia Pet. Co.'s No. 1 Morse, 330 ft. N and W, S½ NE, Sec. 5, Blk. 26, H.&G.N. Sur. ..... Rotary rig on ground.

Magnolia Pet. Co.'s No. 2 Sailor, 330 ft. S and W, E½ NE, Sec. 138, Blk. 3, I.&G.N. Sur. ..... Bldg. rig.

Midwest Explin. Co.'s No. 1-B Taylor, 660 ft. N and W, Sec. 7, Blk. H, A. W. Willard Sur. ..... Standardizing 2,454 ft.

Midgray Oil Co.'s No. 1 McCullough, 267 ft. N, 150 ft. E of 246.9 ac. in Sec. 153, Blk. 3, I.&G.N. Sur. ..... Fishing 2,065 ft.

Nelson et al's No. 1 Crews, 330 ft. S and E, NW, Sec. 12, Blk. 25, H.&G.N. Sur. ..... Fishing for bit; T.D. 2,620 ft.

North American O. & G. Co.'s No. 1 Duncan, 310 ft. N, 660 ft. E, E½ SW, Sec. 135, Blk. 3, I.&G.N. Sur. .... Drlg. 850 ft.

North American O. & G. Co.'s No. 1 Sullivan, 1,320 ft. S and E, Sec. 160, Blk. 3, I.&G.N. Sur. ..... Cellar.

Operators R. & P. Co.'s No. 1 Arnold, 330 ft. S and E, E½ NE, Sec. 149, Blk. 3, I.&G.N. Sur. ..... T.D. 3,250 ft; 1,200 ft. oil in hole from 3,210 ft; to shoot.

Operators R. & P. Co.'s No. 1-A Arnold, 330 ft. S and W, Sec. 148, Blk. 3, I.&G.N. Sur. ..... Rig.

Phillips Pet. Co.'s No. 1 Barrett, 330 ft. S, 150 ft. W, W½, N 56 ac., Sec. 1,360, Blk. 3, I.&G.N. Sur. ..... Drlg. 2,310 ft.

Phillips Pet. Co.'s No. 2 Barrett, 130 ft. N, 465 ft. W, Sec. 136, Blk. 3, I.&G.N. Sur. ..... Drlg. 1,960 ft.

Prairie O. & G. Co.'s No. 1 Reynolds, 330 ft. S and E, NW, Sec. 84, Blk. 3, I.&G.N. Sur. ..... Drlg. 2,920 ft; estimated 1,000,000 ft. gas 2,590-2,920 ft.

W. A. Scott's No. 1 Cobb, 330 ft. S, 425 ft. W, N½ SE, Sec. 184, Blk. 3, I.&G.N. Sur. ..... Estimated 4,000,000 ft. gas 2,875 ft; drlg. 3,007 ft.

Shamrock O. & G. Co.'s No. 1 Reynolds, 330 ft. N and E, SE SE, Sec. 84, Blk. 3, I.&G.N. Sur. ..... Drlg. 3,017 ft; S.O. 2,905 ft. and 2,994 ft.

Skelly Oil Co.'s No. 1 Vicars, 330 ft. N and E, W½, Sec. 127, Blk. 3, I.&G.N. Sur. ..... T.D. 3,290 ft; T.P. 3,225 ft; swbd. 260 bbls. in 12 hrs.

Skelly Oil Co.'s No. 1 Heitholt, 150 ft. N, 3,806 ft. W, Sec. 153, Blk. 3, I.&G.N. Sur. ..... Drlg. 2,700 ft; 5,000,000 ft. gas.

Skelly Oil Co.'s No. 2 Vicars, 330 ft. N and W, SW, Sec. 127, Blk. 3, I.&G.N. Sur. ..... T.D. 3,261 ft; shot with 200 qts. 3,193-3,261 ft; C.O.

Smith's No. 1 Morse, 200 ft. S, 330 ft. W, Sec. 6, Blk. 26, H.&G.N. Sur. ..... 3,000,000 ft. gas 2,150-70 ft; S.D. 2,892 ft; 400 ft. oil in hole.

Southern Explin. Co.'s No. 1 Baird, 330 ft. S and W, NW, Sec. 127, Blk. 3, I.&G.N. Sur. ..... Drlg. 2,890 ft.

Southern States Gas Co.'s No. 1 Case, 330 ft. N and W, E½, Sec. 181, Blk. B-2, H.&G.N. Sur. ..... Cellar.

Sullivan & Ochiltree's No. 1-A Morse, 330 ft. S and W, N¼ NE, Sec. 15, Blk. A-9, H.&G.N. Sur. ..... Rig.

The Texas Co.'s No. 3 Brown, 150 ft. S, 330 ft. W of 247-ac. lease, Sec. 137, Blk. 3, I.&G.N. Sur. ..... Drlg. 2,135 ft.

Yon et al's No. 1 Morse, 330 ft. S and W, N½ SW, Sec. 17, Blk. A-9, H.&G.N. Sur. ..... Cellar.

HUTCHINSON COUNTY

Dixon Creek Oil Co.'s No. 1 Johnson Bros. 330 ft. N and W of E 60 ac. of NW 100 ac., Sec. 1, Blk. X03, H.&O.B. Sur. ..... Drlg. 2,640 ft.

Great Plains O. & G. Co.'s No. 1 Sanford, C of S 160 ac. of N 320 ac., Sec. 87, Blk. 46, H.&T.C. Sur. ..... S.D. 2,750 ft.

Huber Prod. Co.'s No. 1 Johnson Bros., 330 ft. N and E, E½ NW, Sec. 30, Blk. Y, A.&B. Sur. ..... S.D. 2,800 ft.

Huber Prod. Co.'s No. 1 Johnson Bros. (Pure), 330 ft. S and E of E 240 ac., Sec. 29, Blk. Y, A.&B. Sur. .. T.D. 3,052 ft; C.O. after shot.

Huber Prod. Co.'s No. 1 Johnson Bros. (Premier), 330 ft. N and E, of W 60 ac., N 80 ac., NW, Sec. 3, Blk. Y, A.&B. Sur. ..... Rotary rig.

Liner Drlg. Co.'s No. 1-D Johnson Bros., 330 ft. N and E, W½ SW, Sec. 6, Blk. 1, B.&B. Sur. ..... Bldg. rotary rig.

Texas Interstate P. L. Co.'s No. 1 Bivins, C E½ of N 160 ac., Sec. 91, Blk. 6, H.&T.C. Sur. ..... Rigging up.

Lanier et al's No. 1 Johnson Bros., 990 ft. S, 330 ft. E, W½ SE, Sec. 29, Blk. Y, A.&B. Sur. ..... Spudded.

Phillips Pet. Co.'s No. 1-A Pease, 330 ft. S, 330 ft. E, Sec. 9½, Z. E. Collier Sur. ..... T.D. 3,100 ft; T.P. 3,075 ft; C.O. S.O. 3,039 ft.

Prairie O. & G. Co.'s No. 1 Read, C SW, J. M. McDonald Sur. ..... Set 6-in. csg. 3,039 ft.

Sinclair O. & G. Co.'s No. 1-C Johnson Bros., 330 ft. N and W, NE, Sec. 32, Blk. Y, A.&B. Sur. ..... Fishing 2,915 ft.

Sinclair O. & G. Co.'s No. 1-A Johnson Bros., 330 ft. N, 430 ft. E, NW, Sec. 32, Blk. Y, A.&B. Sur. ..... Drlg. 635 ft.

Skelly Oil Co.'s No. 1 Johnson Bros., 660 ft. S and W, SE, Sec. 30, Blk. Y, A.&B. Sur. ..... S.O. 3,065 ft. and 3,108-10 ft; S.D. 3,110 ft.

Spurlock et al's No. 1-A Christian, 440 ft. S, 330 ft. W, NE cor. SE SE, Sec. 33, Blk. Y ..... 60,000,000 ft. gas; S.D. 3,219 ft.

Stansylvanian Oil Co.'s No. 1 Whittenburg, 330 ft. S and W, Sec. 129, Blk. Z, E.L.R.R. Sur. ..... S.D. 3,075 ft.

LIPSCOMB COUNTY

Brown et al's No. 1 Box T Ranch, SW NE, Sec. 612, H.&T.C. Sur. ..... S.G. 3,760 ft; S.D. 4,142 ft.

Okla. Public Service Co.'s No. 1 C. W. Jones, NE SW. Sec. 100, H.&T.C. Sur. ..... Lowering 5 3/16-in. csg; T.D. 5,-003 ft.

LUBBOCK COUNTY

Center Oil Co.'s No. 1 Bowles Ranch ..... Small S.O. 1,133-40 ft; S.D. 4,-167 ft.

MOORE COUNTY

Dana O. & G. Co.'s No. 1 R. Utey, 330 ft. N, 330 ft. E, W½ SE, Sec. 135, T.&N.O. Sur. ..... Rig on ground.

Delmar Oil Co.'s No. 1-A Jones, 330 ft. N, 990 ft. E, NW, Sec. 171, Blk. 3-T, T.&N.O. Sur. ..... Drlg. 3,060 ft.

Gulf Prod. Co.'s No. 1 Dare, C SE, Sec. 312, Blk. 44, H.&T.C. Sur. ..... Location.

Home Gas Co.'s No. 1 Reeder, 330 ft. N and W, N½ E½ NE, Sec. 191, Blk. 3-T, T.&N.O. Sur. ..... Drlg. 3,204 ft; 25,000,000 ft. gas 3,139-3,200 ft.

Morton et al's No. 1 Rupert, 660 ft. N, 330 ft. E, NW, Sec. 191, Blk. 3-T, T.&N.O. Sur. ..... Cellar.

Shamrock O. & G. Co.'s No. 1 Sullivan, 330 ft. S and E, NE, Sec. 139, Blk. 3-T, T.&N.O. Sur. ..... Rigging up.

Sunray Oil Co.'s No. 1 C. R. Jones, 330 ft. E, 330 ft. S, W½ SW, Sec. 164, T.&N.O. Sur. ..... T.D. 3,075 ft; to kill 101,000,000 ft. gas to deepen.

Sunray Oil Co.'s No. 2 Jones, 330 ft. S, 990 ft. E, W½ SW, Sec. 164, Blk. 3-T, T.&N.O. Sur. ..... Rig on ground.

Texas Interstate P. L. Co.'s No. 1 Sneed, Jr., C NE, Sec. 6, Blk. B-10, E.L.&R.R. Sur. ..... Drlg. 1,340 ft.

MOTLEY COUNTY

Matador Oil Corp.'s No. 1 Owens, C NE, Sec. 10, Blk. G, B.&B. Sur. ..... S.D. 580 ft.

OLDHAM COUNTY

Amalgamated German-American Oil Corp.'s No. 1 Norton, 330 ft. S and E, Sec. 12, T.&N.O. Sur. ..... Rotary rig.

Chambers et al's No. 1 Herring, CNL, Sec. 29, Blk. S, G.C.&S.F. Sur. ..... S.D. 630 ft.

POTTER COUNTY

Canadian River Gas Co.'s No. 1 McBride estate "A," 4,950 ft. S, 330 ft. W, E½ S½, Sec. 98, Blk. 46, H.&T.C. Sur. ..... S.D. 2,090 ft.

Texas Interstate P. L. Co.'s No. 1 Rockwell, C N½ S½, Sec. 102, Blk. 46, H.&T.C. Sur. ..... Location.

RANDALL COUNTY

W. A. Patterson's No. 1 Palo Duro, Sec. 60, Blk. K-14 .. S.D. 1,250 ft.

WHEELER COUNTY

Guernsey Oil Co. et al's No. 1 Sewell, 320 ft. N and E, Sec. 33, Blk. 13, H.&G.N. Sur. ..... Drlg. 1,550 ft.

McGee et al's No. 1 Jolly, C NE, Sec. 15, Blk. A-8, H. &G.N. Sur. ..... Drlg. 2,180 ft.

Mid-Kansas O. & G. Co.'s No. 1 Harvey, 660 ft. S and W, NE, Sec. 56, Blk. 33, H.&G.N. Sur. ..... Drlg. 800 ft.

Wischkamper et al's No. 1 Kiser, 330 ft. N and E, SW, Sec. 33, Blk. 17, H.&G.N. Sur. ..... S.D. 2,340 ft.

Woodley et al's No. 1 Sloss & Admire, 660 ft. N, 330 ft. E, Sec. 47, Blk. 13, H.&G.N. Sur. ..... Drlg. 1,505 ft.

Vollmert's No. 1 Porter, 330 ft. S and E, NE, Sec. 15, Blk. 27, H.&G.N. Sur. ..... S.D.

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LOUISIANA-ARKANSAS PROVEN AREAS

(Rotary operations unless otherwise designated.)

(Continued from Page 64)

UNION PARISH

Bahan & Bahan's No. 2 Tanner, 3,300 ft. N, 1,980 ft. W, SE cor., Sec. 19-22-4 ..... Cmtd. 6-in. 2,050 ft.

E. S. Hall's No. 5 Spencer, 1,980 ft. E, 600 ft. N, SW cor., Sec. 14-20-3 ..... Began drlg. Oct. 28; cmtd. 12½-in. 175 ft; 8-in. 787 ft; drlg. 1,230 ft.

La. G. & F. Co.'s No. 12 Smith (was Ouachita Nat. Gas Co.'s), 2,152 ft. N, 708 ft. E, SW cor., Sec. 20-20-4 ..... Location.

WEBSTER PARISH—SAREPTA AND SHONGALOO

Magnolia Pet. Co.'s No. 3 Denman, 369 ft. S, 513 ft. W, NE cor. NE NW, Sec. 1-22-11 ..... Cmtd. 6⅝-in. 2,727 ft; T.D. 2,741 ft.

ARKANSAS

JOHNSON COUNTY

Ark.-La. P. L. Co.'s No. 1 Hudson et al, 660 ft. N, 545 ft. E, SW cor. SE NE, Sec. 14-10-24 ..... Drlg. 1,250 ft.

Ark.-La. P. L. Co.'s No. 1 Mattie Kelly, 330 ft. S, 657 ft. E, NW cor. SW SW, Sec. 14-10-24 ..... Drlg. hard sand 2,218 ft.

River Valley Gas. Dev. Co.'s No. 1 W. F. Collier, 350 ft. S, 330 ft. E, NW cor. SE SE, Sec. 21-9-25 ..... Location.

OUACHITA COUNTY—SMACKOVER

L. H. Hamilton's No. 3 Doyle, 100 ft. E, 400 ft. N, SW cor. SE SE, Sec. 23-15-16 ..... Began drlg. Sept. 24; cmtd. 10-in. 40 ft; S.D.

W. J. Thomas' No. 1 Usserey & Arnold, 200 ft. N, 200 ft. W, SE cor. NW, Sec. 36-15-15 ..... Drlg. 2,062 ft.

SEBASTIAN COUNTY

Mansfield Gas Co.'s No. 14 fee, Lot 10, Sec. 1-4-31 ..... Drlg. hard sand 1,550 ft.

Ozark Nat. Gas Co.'s No. 10 Weaver, 660 ft. N, 660 ft. W, SE cor. SE NE, Sec. 27-8-30 ..... Straightening hole; T.D. 2,640 ft.

Ozark Nat. Gas Co.'s No. 1 Bates, C SE NW, Sec. 28-8-30 .. Tested est. 5,000,000 ft. gas; drlg. 2,990 ft.

UNION COUNTY—CHAMPAGNOLLE

Lion Oil Ref. Co.'s No. 1 Sullivan, 330 ft. N, 330 ft. W, SE cor. SE NW, Sec. 12-17-14 ..... Began drlg. Nov. 3.

Lion Oil Ref. Co.'s No. 2 Sullivan, 933 ft. S, 200 ft. W, NE cor. NE NW, Sec. 12-17-14 .. .. Rig up.

Ohio Oil Co.'s No. 10 Crain, 330 ft. S, 330 ft. W, NE cor. SE SW, Sec. 1-17-14 ..... Rig up.

UNION COUNTY—EL DORADO

Malloy & Co.'s No. 7 Burns, SW cor. NW NW, Sec. 31-17-15 ..... W.O.S.R; 35 ft. fluid 2,213 ft.

Rice Drlg. Co.'s No. 1 Watley, 150 ft. S, 150 ft. E, NW cor. SW, Sec. 7-17-15 ..... Drlg. 110 ft.

Weisinger & Boll's No. 8 Goodwin, 175 ft. N, 150 ft. E, SW cor. NE NW, Sec. 6-18-15 ..... W.O.S.R; to drill in with cable tools, 2,112 ft.

UNION COUNTY—SMACKOVER

J. E. Crosbie, Inc.'s No. 1 G. L. Murphy, 300 ft. N, 300 ft. W, SE cor. SW NW, Sec. 13-16-16 ..... 700 ft. of 23.5 gravity oil at 99 ft; W.O.S.R; 2,740 ft.

EAST TEXAS

HARRISON COUNTY

Calatex O. & G. Co.'s No. 6 Argus, 755 ft. N, 699 ft. W, Mile Post 27, in J. Womack Sur. ..... Location.

Shell Rock Pet. Co.'s No. 1 Oliver Dougherty, W. D. Burris Sur. ..... S.D. brown chalk 3,520 ft.

PANOLA COUNTY

Ark.-La. P. L. Co.'s No. 2-A G. W. Brumble, 477 ft. W, 473 ft. S, NW cor. Jno. Womack Sur., in B. C. Jordan Sur. ..... Drlg. lime 4,008 ft.

W. G. Banks et al's No. 1 C. O. Baldwin, 1,395 ft. W, 1,362 ft. S, NE cor. Baldwin 290 ac. in Hampton West Sur. ..... Derrick.

S. E. Bell et al's No. 1 Burnett Lbr. Co., C, S. B. Hendricks Sur. ..... Drlg. lime 2,200 ft.

Creighton & Hart's No. 1 Greeny-Kyle, C, Greeny-Kyle 60 ac., Jas. Tippett Sur. ..... Hole clean; drlg. shale 3,004 ft.

Texas-La. Prod. Co.'s No. 1 Baker, 1,000 ft. N, 550 ft. W, SE cor 63-ac. Baker tract, in B. C. Jordan Sur.... Began drlg. Nov. 2; cmtd. 12½-in. 367 ft.

Knox et al's . o. 1 Dunham (was Jackson et al's), 150 ft. W, 150 ft. N, SE cor. M. I. Dunham 29 ac., in Chas. Haley Sur. ..... Small show oil; cmtd. 6⅝-in. 2,670 ft; T.D. 2,732 ft.

Nat. Gas Prod. Co.'s No. 1 H. H. Alvord, 6,777 ft. S, 6,162 ft. E, NW cor., B. C. Jordan Sur. ..... Rig up.

Doris Thomason's No. 15 Crenshaw, 1,992 ft. S, 2,305 ft. E, SW cor., Jno. Womack Sur. in B. C. Jordan Sur.... Derrick.

MISSISSIPPI

RANKIN COUNTY

Feazel O. & G. Co.'s No. 1 Cox, SE cor. SE SE, Sec. 12-5-1e .. .. Location.

Gulf Ref. Co.'s No. 1 Hamilton, 1,320 ft. N, 1,320 ft. E, SW cor., Sec. 12-5-1e ..... Cmtd. 9-in. 2,550 ft; T.D. 2,566 ft.

Dr. S. D. Raymond's No. 1 Graves, 1,810 ft. N, 3,210 ft. W, SE cor., Sec. 12-5-1e ..... Began drlg. Oct. 24; cmtd. 15½-in 35 ft; drlg. sand 650 ft.

Pioneer O. & G. Co.'s No. 1 Graves, 1,810 ft. N, 3,210 ft. W, SE cor., Sec. 12-5-1e ..... Drlg. 1,625 ft.

Southern Pet. Co.'s No. 1 Ivey, SE, Sec. 12-5-1e ..... Derrick.

Wallace Oil Co.'s No. 1 Cobb, SW cor. SE NE, Sec. 12-5-1e ..... Derrick. Rig up.

NORTH LOUISIANA

BOSSIER PARISH—BELLEVUE

La. Oil Ref. Corp.'s No. 14-B Bodcaw, 450 ft. W, 330 ft. S, NE cor. SE SW, Sec. 11-19-11 ..... Derrick.

H. I. Morgan's No. 10-B Kendrick, 1,720 ft. E, 1,120 ft. N, SW cor., Sec. 22-19-11 ..... Cmtd. 10-in. 154 ft; drlg. 1,350 ft.

BOSSIER PARISH—CARTER

Del.-La. Dev. Co.'s No. 6 Bollinger, 330 ft. S, 220 ft. W, NW cor., Lot 17, in Lot 16, Sec. 31-23-11 ..... Hole full oil; W.O.S.R; 15 ft. broken sand; T.D. 3,217 ft.

Palmer Corp.'s No. 2 Roberson, 330 ft. N, 330 ft. E, SW cor. NW NE, Sec. 26-23-12 ..... Derrick.

The Texas Co.'s No. 1 Pine Wood Lbr. Co., 1,650 ft. S, 300 ft. E, NW cor., Sec. 25-23-12 ..... Cmtd. 3,130 ft; T.D. 3,149 ft.

The Texas Co.'s No. 16 Wilkinson, 330 ft. N, 330 ft. E, SW NE, Sec. 36-23-12 ..... C.O; T.D. 3,161 ft.

Tippett Drlg. Co.'s No. 3 Holmes, 330 ft. N, 330 ft. E, SW cor. NE NW, Sec. 36-23-12 ..... 300 ft. oil in hole; waiting on power; T.D. 3,130 ft.

BOSSIER PARISH—ELM GROVE

R. O Roy's No. 1 Hunter, 660 ft. N, 660 ft. E, SW cor., Sec. 24-16-11 ..... Drlg. 2,000 ft.

BOSSIER PARISH—SLIGO

La. G. & F. Co.'s No. 3 Jeter, 4,650 ft. W, 660 ft. S, NE cor., Sec. 24-17-12 ..... Reported completed in error; cemented 9-in. 2,408 ft.

Palmer Corp.'s No. 1 Schnitt, 660 ft. S, 660 ft. E, C, Sec. 14-17-12 ..... O.W.D.D; arranging to deepen 877 ft.

Woodley Pet. Co.'s No. 3 Harris, 247 ft. E, 660 ft. N, SW cor. SE NE, Sec. 14-17-12 ..... D.S. test 1,700 ft; dry; drlg. 2,420 ft.

Woodley Pet. Co.'s No. 4 Harris, 247 ft. E, 440 ft. N, SW cor. SE NE, Sec. 14-17-12 ..... Location.

CADDO PARISH—GREENWOOD

Calatex O. & G. Co.'s No. 1 Edgar, 1,460 ft. S, 1,900 ft. E, NW cor., Sec. 17-16-16 ..... Location.

Calatex O. & G. Co.'s No. 1 McAnn-Alfred, 1,310 ft. S, 970 ft. E, NW cor., Sec. 17-16-16 ..... Location.

CADDO PARISH—HOSSTON

Bayou State Oil Corp.'s No. 5 Barr, Sec. 30-22-15 ..... Rig up.

CADDO PARISH—OIL CITY

The Texas Co.'s No. 73 Levee Board, 1,642 ft. E, 780 ft. N, SW cor. SW SE, Sec. 27-21-16 ..... Location.

The Texas Co.'s No. 74 Levee Board, 1,600 ft. S, 200 ft. W, NE cor., Sec. 33-21-16 ..... Derrick.

The Texas Co.'s No. 75 Levee Board, 2,450 ft. S, 224 ft. W, NE cor., Sec. 33-21-16 ..... Derrick.

CADDO PARISH—PINE ISLAND

Shreveport Oil Corp.'s No. 1-A Muslow, 150 ft. S, 150 ft. E, NW cor., Sec. 32-21-15 ..... D.S. test 2,190 ft; dry; arranging to plug back.

Tholl Oil Co.'s No. 13 Bashara, 75 ft. N, 300 ft. W, SE cor., Sec. 23-21-15 ..... Drlg. 1,085 ft.

CLAIBORNE—HOMER

La. Oil Ref. Corp.'s No. 10 Langston, 660 ft. S, 528 ft. E, NW cor. SW SW, Sec. 19-21-7 ..... Derrick.

CLAIBORNE PARISH—SUGAR CREEK

Triangle Drlg. Co.'s No. 1 Brownfield, 660 ft. S, 660 ft. E, NW cor. NE, Sec. 6-19-5 ..... D.S. stuck; T.D. 4,049 ft.

Triangle Drlg. Co.'s No. 1 J. W. Stevenson, 670 ft. N, 665 ft. W, SE cor. SW SE, Sec. 6-19-5 ..... Cmtd. 9-in. 4,060 ft.

Standard Oil Co.'s No. 4-A Farmer, 330 ft. S, 330 ft. E, NW cor. NE NW, Sec. 5-13-13 ..... Drlg. 2,219 ft.

DE SOTO PARISH—HOLLY

Standard Oil Co.'s No. 1-B Dowling Bros., 200 ft. N, 396 ft. W, SE cor. SW SW, Sec. 32-14-13 .. .. Rig up.

LA SALLE PARISH—URANIA

Montugu Oil Co.'s No. 9 Zenoria Lbr. Co., 660 ft. W, 200 ft. S, NE cor., Sec. 10-9-1e ..... Began drlg. Oct. 15; cmtd. 10-in. 103 ft., 6-in. 1,491 ft; W.O.S.R 1,508 ft.

Montugu Oil Co.'s No. 10 Zenoria Lbr. Co., 160 ft. S, 160 ft. E, NW cor., Sec. 11-9-1e ..... Derrick.

MOREHOUSE PARISH

Bahan & Bahan's No. 4 Feazel, 900 ft. W, 330 ft. S, NE cor., Sec. 2-20-4 ..... Location.

La. G. & F. Co.'s No. 3 Sandige (was Industrial Gas Co.'s), 560 ft. N, 660 ft. E, SW cor. SE, Sec. 15-20-4... Drlg. 1,825 ft.

Texas-La. Prod. Co.'s (was Moody-Seagraves Gas Co.'s) No. 1 Fisher, 660 ft. E, 3,814 ft. N, SW cor., Sec. 34-21-5 ..... Coring 2,335 ft.

OUACHITA PARISH

La. G. & F. Co.'s No. 4 fee (was Industrial Gas Co.'s), 1,334 ft. N, 652 ft. W, SE cor., Sec. 2-19-3 ..... Location.

Jordan Drlg. Co.'s No. 7 Cole, 265 ft. S, 1,459 ft. W, NE cor., Sec. 49, in Sec. 50-18-4 ..... Location.

Jordan Drlg. Co.'s No. 1 School, 216 ft. S, 244 ft. W, NE cor. NW, Sec. 16-18-4 ..... Began drlg. Oct. 28; cmtd. 12½-in. 180 ft; drlg. 1,050 ft.

Pipes & Mack's No. 1 Robertson & Reed, 990 ft. W, 330 ft. S, NE cor. SE, Sec. 10-18-4 ..... Location.

Pipe & Mack's No. 2 Union Gas Products Co., 296 ft. W, 528 ft. N, SE cor. SW, Sec. 7-18-5 ..... Location.

United Carbon Co.'s No. 6 Spade, 1,180 ft. S, 140 ft. E, NW cor., Sec. 27-19-4 ..... Location.

RICHLAND PARISH

W. C. Feazel's No. 1 R. B. Simon, 2,406 ft. W, 2,020 ft. S, NE cor., Sec. 11-16-6 ..... Rig moved; derrick.

Franklin O. & G. Co.'s No. 1 Thompson, 660 ft. N, 165 ft. W, SE cor. NE, Sec. 14-16-6 ..... Location.

Hope Prod. Co.'s No. 1 Thomason, 1,980 ft. N, 660 ft. E, SW cor., Sec. 14-16-6 ..... Began drlg. Oct. 29; cmtd. 12-in. 188 ft; 8-in. 890 ft; drlg. 1,850 ft.

La. G. & F. Co.'s No. 1-A Noble, 1,320 ft. N, 580 ft. W, SE cor. NE, Sec. 35-16-5 ..... Cmtd. 9-in. 857 ft; drlg. 1,212 ft.

Palmer Corp.'s No. 1-B Boykin, 177 ft. S, 787 ft. E, C, Sec. 33-17-6 ..... Cmtd. 6-in. 2,295 ft.

Palmer Corp.'s No. 1 Holdiness, 552 ft. S, 2,215 ft. W, NE cor., Sec. 8-16-6 ..... Location.

Palmer Corp.'s No. 12 Rhymes-England, 1,320 ft. W, 660 ft. N, SE cor. NW, Sec. 33-17-6 ..... Cmtd. 6-in. 2,300 ft.

Palmer Corp.'s No. 13 Rhymes-England, 561 ft. W, 66 ft. N, SE cor., Sec. 29-17-6 ..... Cmtd. 9-in. 916 ft; drlg. 1,750 ft.

Southern Carbon Co.'s No. 1 J. A. Clements, 1,320 ft. S, 1,980 ft. W, NE cor., Sec. 10-16-6 ..... Cmtd. 8-in. 940 ft; drlg. 1,365 ft.

Southern Carbon Co.'s No. 1-B Hale, 1,320 ft. N, 660 ft. E, SW cor., Sec. 15-16-6 ..... Location.

Southern Carbon Co.'s No. 1-C Hemler, 1,164 ft. S, 888 ft. W, NE cor., Sec. 14-16-6 ..... Began drlg. Nov. 1; drlg. 190 ft.

Southern Carbon Co.'s No. 2-C M. L. McCoy, 1,880 ft. N, 5,024 ft. E, SW cor., Sec. 1-16-6 ..... S.D. 2,491 ft.

Southern Carbon Co.'s No. 1-D M. and M. McCoy, 1,980 ft. S, 660 ft. W, NE cor., Sec. 30-16-6 ..... Location.

Southern Carbon Co.'s No. 7 F. B. and E. A. Sartor, 2,540 ft. S, 660 ft. E, NW cor., Sec. 17-16-7 ..... Location.

Southern Carbon Co.'s No. 1-C Thomason, 1,980 ft. N, 1,400 ft. W, SE cor., Sec. 14-16-6 ..... Drlg. 2,210 ft.

Southern Carbon Co.'s No. 1-E Thomason, 3,300 ft. S, 100 ft. E, NW cor., Sec. 32-16-6 ..... Location.

State Line O. & G. Co.'s No. 1-A Boughton, 1,883 ft. E, 127 ft. S, NW cor. SW, Sec. 33-16-6 ..... Cmtd. 9-in. 863 ft; drlg. 1,400 ft.

State Line O. & G. Co.'s No. 1 Hewitt, 1,721 ft. S, 957 ft. E, NW cor. SW, Sec. 32-16-6 ..... Location.

United Carbon Co.'s No. 1 J. A. Hemler, 660 ft. W, 66 ft. N, SE cor., Sec. 5-16-6 ..... Began drlg. Oct. 28; cmtd. 12-in. 185 ft.

United Carbon Co.'s No. 2 C. M. Noble, 805 ft. W, 1,498 ft. N, common cor. Secs. 7, 8 and 38-15-16 in Sec. 37 .. Cmtd. 12-in. 185 ft; 8-in. 831 ft.

SABINE PARISH—PLEASANT HILL

F. A. Bartlett, Jr.'s No. 1 Logan, 200 ft. S, 200 ft. E, NW cor., Sec. 27-10-12 ..... S.D. 2,400 ft.

WILDCAT OPERATIONS IN LOUISIANA-ARKANSAS

(Rotary operations unless otherwise designated.)

(Continued from Page 64)

Oil Field Corp.'s No. 1 Simmons, 330 ft. S, 330 ft. E, NW cor., Sec. 13-18-13 ..... D.S. test 2,301 ft; dry; 3 joints mud and oil 2,326 ft; drlg. 2,775 ft.

VAN BUREN COUNTY

Glenn Kohle et al, trustee's No. 1 Scalan, 200 ft. S, 200 ft. W, NE cor. SE NW, Sec. 5-19-13 ..... S.D. 50 ft.

WASHINGTON COUNTY

(Cable tools)

Delbert & Graves' No. 1 Cunningham, Sec. 14-15-32 ..... S.D; W.O. 602 ft.

C. H. Willoughby's No. 1 Jones, Sec. 34-16-30 ..... Pulling csg. to ream; T.D. 1,697 ft.

Lincoln Leaseholding Synd.'s No. 1 Lincoln, Sec. 30-15-32.. U.R. 8-in. to T.D. 1,500 ft.

H. H. Taylor et al's No. 1 Runny, C NE SW, Sec. 1-13-29.. S.D. for csg. 1,165 ft; (C.D.).

YELL COUNTY

(Cable tools)

Tegmeier & Luckett's No. 1 Falcon, Sec. 36-7-21 ..... Fishing tools 5,710 ft.

EAST TEXAS

BOWIE COUNTY

Joe Burnham et al's No. 1 G. W. Burnett, 150 ft. W, 400 ft. S, NE cor. G. W. Burnett 76 ac., in W. H. Janes Sur. ..... Drlg. 3,015 ft.

Maud-Redwater Oil Co.'s No. 1 Merritt, 175 ft. N, 175 ft. E, SE cor. G. W. Hardige 100-ac. tract on Floyd Merritt tract in Y. S. McKinney Sur. ..... Derrick.

CAMP COUNTY

McDonald Bros.' No. 1 Tillery, 150 ft. E, 450 ft. S, NW cor. 137-ac. tr., in J. H. Murphy Sur. ..... Cored sand 3,510-16 ft; drlg. 3,600 ft.

CASS COUNTY

Wesley Morse et al's No. 1 Henderson, 800 ft. E, 1,100 ft. S, NW cor. C. E. Bailey Sur. ..... Location.

Phillips Pet. Co.'s No. 1 J. R. Olds, 300 ft. N, 170 ft. E, SW cor., J. A. Stephenson Sur. ..... Drlg. 900 ft.

John C. Rogers' No. 1 I. E. Lanier, 573 ft. N, 879 ft. W, SE cor. Lanier 86 ac. in K. E. Welborn Sur. ..... Cored sand showing oil 2,160 ft, arranging D.S. test.

The Texas Co.'s No. 1 Citizens State Bank, 2,793 ft. W, 300 ft. S, NE cor., Jas. Watkins Sur. ..... Began drlg. Oct. 29; cmtd. 10-in. 158 ft; top Nacatoch 1,891 ft; drlg. hard sand 1,953 ft.

MARION COUNTY

P. E. Hussey's No. 1 A. A. Trammell, Chas. Lockhart Sur. ..... Claim 5-ft. core showing oil 1,884 ft.

RED RIVER COUNTY

D. M. Buffington's No. 1 Hossier, E. Hughhart Sur. ..... S.D. 2,865 ft.

Johnson Pet. Co.'s No. 2 Randolph, Edw. Dean Sur. ..... Swedging 2 jts. collapsed 8-in; arranging to cmt. 6⅝-in. and packer 2,182 ft.

SABINE COUNTY

Benedum & Trees Oil Co.'s No. 1 Nona Mills Lbr. Co., Jas. Mason Sur. ..... D.S. test 4,178-4,242 ft; 1,000,000 ft. gas; arranging to cmt. 9-in.

SHELBY COUNTY

Chapparell Oil Co.'s No. 2 Holt, Matthew Moore Sur. ..... T.A. hard lime 3,350 ft.

G. R. Ridgeway's No. 1 G. D. Parker, 4,930 ft. E, 750 ft. N, SW cor., Jessie McKelvey Sur. ..... Drlg. 2,506 ft.

MISSISSIPPI

ALCORN COUNTY

Alcorn Pet. Co.'s No. 1 Matthews, SE cor., Sec. 14-2s-7e. .. Fishing 6-in. and tools 2,392 ft; T.D. 2,735 ft.

ATTALA COUNTY

K. A. March's No. 1 H. A. Moore, 500 ft. W, 330 ft. S, NE cor. SE NW, Sec. 2-15-5e ..... Began drlg. Oct. 29; drlg. 200 ft.

CLAY COUNTY

Ohio Oil Co.'s No. 1 Cantrell, NE cor., Sec. 16-16-5 ..... Drlg. sandy lime 1,965 ft.

CHICKASAW COUNTY

Hightower & Golson's No. 1 Flemming, NE cor., Sec. 20-13-3 ..... Driving 8¼-in. 1,534 ft; T.D. 1,700 ft.

GRENADA COUNTY

F. E. West et al's No. 1 Dubard, NW NW, Sec. 18-23-4. .. Derrick.

HINDS COUNTY

Attkison & Dyers' No. 1 Wiggins, Sec. 33-6-1e ..... Derrick.

Big Block Oil Co.'s No. 1 Southern Christian Institute, C N½ NE, Sec. 30-6-4 ..... S.D. 1,910 ft; will drop from report.

Cane River O. & G. Co.'s No. 1 Kabbies, NE cor. SW SW, Sec. 15-5-1e ..... Drlg. sandy shale 1,865 ft.

Gulf Ref. Co.'s No. 1 McLaurin, 1,230 ft. S, 1,410 ft. W, NE cor., Sec. 30-6-2e ..... Began drlg. Oct. 30; cmtd. 15½-in. 87 ft; drlg. 650 ft.

Hawkeye Gas Co.'s No. 1 Webster, NW cor. NE NW, Sec. 15-5-1e ..... Waiting for 4½-in. to set inside 6⅝-in. 2,474 ft; T.D. 2,476 ft.

Howard Oil Co.'s No. 1 Jackson College, C NW NW, Sec. 9-5-1e ..... Rig up.

Jackson Oil Co.'s No. 1 Central Cotton Oil Co., NW cor., SW NW, Sec. 2-5-1e ..... Rig up.

Dr. Barney Kennedy's No. 1 Fee, 150 ft. E, 200 ft. N, SW cor. NE NE, Sec. 24-6-1e ..... Location.

Love Pet. Co.'s No. 1 Maley, SE cor. NW, Sec. 15-5-1e. .. Top Midway 2,387 ft; top chalk 2,487 ft. and cmtd. 6⅝-in; claim oil show estimated 10 bbls., 13° gravity clean oil, no gas 2,487-2,490 ft; flowed 25 bbls. oil and 300 bbls. wtr. 105° F; T.D. 2,494 ft; W.O.S.R.

Love Pet. Co.'s No. 1 Morton Lbr., Co., 1,500 ft. E, 1,525 ft. N, SW cor., Sec. 34-6-1e ..... Began drlg. Nov. 1; cmtd. 15½-in. 47 ft.

Miss. Pet. Co.'s No. 1 Baptist Orphanage, 175 ft. E, 130 ft. N, SW cor. SE SE, Sec. 28-6-1e ..... Waiting for csg; T.D. 2,475 ft.

Miss. Pet. Co.'s No. 1 Solvent Inv. Co., NE cor. NE SW SW, Sec. 14-5-1w ..... S.D. 2,710 ft.

Miss.-Tex. Oil Co.'s No. 1 Negro Fair Assn., SW cor. NW SE, Sec. 28-6-1e ..... S.D; 6⅝-in. parted 500 ft. off bottom; T.D. 2,479 ft.

Mrs. Reeder et al's No. 1 State, SE cor. NW NW, Sec. 25-6-1e ..... W.O; T.D. 2,905 ft; will drop from report.

Tri-State O. & G. Co.'s No. 1 Wilson, SW cor. SE NE, Sec. 23-6-1e ..... Derrick.

Universal Gas Co.'s No. 1 Sharbrough, SW cor. SE, Sec. 28-6-1e ..... Began drlg. July 29; S.D; W.O. 88 ft.

HUMPHRIES COUNTY

E. S. Steele et al's No. 1 C. B. Box, SE cor. SE NE, Sec. 25-14-4w ..... Set 12½-in. 60 ft; S.D.

JASPER COUNTY

Bay Springs Pet. Co.'s No. 1 Keys, C NW NE, Sec. 21-2-10 ..... Derrick.

LAUDERDALE COUNTY

J. R. Smith Oil Co.'s No. 1 C. F. Craig, Sec. 2-16-14. .. Derrick.

LAFAYETTE COUNTY

Banks-Good et al's No. 1 May, 113½ rds. S, 26 rds. E, NW cor. SW, Sec. 22-10-1w ..... Derrick.

LINCOLN COUNTY

Lincoln O. & G. Co.'s No. 1 Pat Case, NE cor. NE, Sec. 21-3-6 ..... S.D; W.O. 2,231 ft; will drop from report.

MADISON COUNTY

Barney Kennedy et al's No. 1 Raymond, 300 ft. E, 1,800 ft. N, SW cor., Sec. 32-7-2e ..... Cmtd. 12½-in. 706 ft.

MONROE COUNTY

Amory Dev. Co.'s No. 1 Bouriand, Sec. 2-13-19. .. Resumed operations Oct. 2; recovered lost bailer; S.D; W.O 3,007 ft.

Amory Pet. Co.'s No. 3 Carter, C SE SE, Sec. 7-13-17. .. Arranging to cmt. 10-in. 565 ft.

Amory Pet. Co.'s No. 1 Harris, SW cor. SE SE, Sec. 18-13-17 ..... Derrick.

Associated Oil Co.'s No. 1 School, SW cor. SW SE, Sec. 16-15-17 ..... Began drlg. Aug. 26; S.D. 32 ft.

Park Bowser et al's No. 1 Cowart, second hole, Sec. 2-12-19 ..... Drlg. 300 ft.

RANKIN COUNTY

R. A. Moore et al's No. 1 Interior Lbr. Co., Sec. 28-6-1e. .. S.D. 900 ft.

Cleve Love's No. 1 Muse, SE cor. SW SW, Sec. 33-7-4e. .. Derrick.

Love Pet. Co.'s No. 1 Moore (was Interior Oil Co.'s), 660 ft. N, 660 ft. W, SE cor. NW NW, Sec. 28-6-2e. .. S.D. 900 ft.

Sabine O. & G. Co.'s No. 1 Taylor, SE cor. SW NE, Sec. 6-5-2e ..... Rig up.

Gulf Ref. Co.'s No. 1 Hamilton, 1,320 ft. N, 1,320 ft. E, SW cor., Sec. 12-5-1e ..... Began drlg. Oct. 3; cmtd. 12½-in 310 ft; drlg. 1,150 ft.

Jackson Royalties, Inc.'s No. 1 Pate, NE cor. NE SE, Sec. 12-5-1e ..... Began drlg. Oct. 5; cmtd. 12½-in. 280 ft; drlg. shale 2,120 ft.

Cleve Love et al's No. 1 Brown, C NW SE, Sec. 12-5-1e. .. Began drlg. Oct. 9; drlg. 1,200 ft.

Pearl River O. & G. Co.'s No. 2 Pate, SE cor. SW SE, Sec. 12-5-1e ..... Began drlg. Oct. 7; cmtd. 10-in. 292 ft.

WARREN COUNTY

Raymond A. Moore et al's No. 1 Clark, SE, Sec. 31-16-5 (no check) ..... Derrick.

Vicksburg Oil Co.'s No. 1 Dornbush, 2,089 ft. S, 1,520 ft. W, NE cor., Sec. 8-18-5 ..... Waiting on drill stem; T.D. 1,350 ft.

WINSTON COUNTY

Miss. Drlg. Co.'s No. 1 Scarbrough, NW cor., Sec. 15-12-14. . Drlg. shale 1,901 ft.

ALABAMA

(Not reported on, will drop from report)

LAMAR COUNTY

Griggs & Knapp's No. 1 Wefel, Sec. 25-12-14 ..... T.A. 1,740 ft.

LAUDERDALE COUNTY

A. D. Morton et al's No. 10 O'Neal est., Sec. 8-3s-13w. .. Cmtd. 12½-in. 125 ft; drlg. hard lime 905 ft.

MARION COUNTY

Hobson et al's No. 1 John Clark, SE, Sec. 29-11-14. .. Derrick pattern.

WASHINGTON COUNTY

S. A. Hobson's No. 1 Hobson Bros., Sec. 9-8-2 ..... S.D; W.O; flow at 1,450 ft.

S. A. Hobson's No. 1 Wilson, Sec. 27-7-1 ..... Fishing bailer; T.D. 881 ft.

Oscar Brown's No. 2 Land & Cotton, Co., Sec. 25-3-2w. .. Drlg. 700 ft.

NORTH LOUISIANA

AVOYLLES PARISH

Company, farm and location—	Remarks—
Gas-Con Oil Corp.'s No. 1 Morrow (no check), Sec. 14-2s-4e	S.D. sand and shale 4,220 ft.
R. E. Tippett's No. 1 Chateline, NE NE, Sec. 34-1n-3e. ..	Cored S.W. sand 3,140-47 ft; S.D. 3,410 ft.

BIENVILLE PARISH

Carter & Dobbs' No. 1 White, 330 ft. N, 330 ft. W, SE cor. SE SE, Sec. 9-18-6 ..... Coring sandy shale 2,200 ft.

Coyle Bros.' No. 1 Lawhon, 300 ft. N, 300 ft. E, SW cor. SE NE, Sec. 15-.6-8 ..... Derrick.

W. A. Nichols et al's No. 1 McDermott, 660 ft. S, 660 ft. W, NE cor. NE NE, Sec. 28-18-6 ..... Recmtng. 6⅝-in. 2,195 ft; T.D. 3,300 ft.

S. P. Borden's No. 1 Thomas, 330 ft. S, 330 ft. E, NW cor., Sec. 27-16-9 ..... Cmtd. 7-in. 4,033 ft; T.D. 4,042 ft.

Olds & Smith's No. 1 Brice, 330 ft. N, 330 ft. E, SW cor. SE SE, Sec. 15-18-6 ..... Arranging to cmt. 6⅝-in. 2,180 ft; T.D. 2,230 ft.

BOSSIER PARISH

Andrews & Davlin's No. 1 Nattin, 100 ft. N, 250 ft. W, C, Sec. 15-22-14 ..... D.S. test 1,546 ft; S.W; S.D; W.O.

Rombaugh et al's No. 1 Allison, SW SE, Sec. 10-19-13. .. Began drlg. Nov. 3; drlg. 75 ft.

CADDO PARISH

Hunter Land & Inv. Co.'s No. 1 Fee, Sec. 32-18-14. .. Began drlg. Oct. 23; drlg. 934 ft.

Tex.-La. Prod. Co.'s No. 1 French, 1,270 ft. N, 675 ft. E, SW cor. NW, Sec. 34-23-16 ..... Drlg. hard lime 3,847 ft.

Tex.-La. Prod. Co.'s No. 1 Wall, 2,715 ft. N, 1,980 ft. W, SE cor., Sec. 33-23-16 ..... Drlg. hard lime 3,067 ft.

CALDWELL PARISH

Hudson et al's No. 1 Burton, Sec. 35-12-2e ..... S.D. 2,012 ft.

CATAHOULA PARISH

National Drlg. Co.'s No. 1 Marsh McMiller, 70 ft. N, 100 ft. W, C, Sec. 26-9-6 ..... D.S. test 1,040-95 ft; small S.G. with S.W. 1,095-1,110 ft; S.W; fishing drill collar and bit; T.D. 2,200 ft.

CLAIBORNE PARISH

Baird Bros. et al's No. 1 Whittaker, 600 ft. N, 400 ft. W, SE cor. NE, Sec. 30-20-7 ..... S.D. 2,200 ft.

Baugh et al's No. 1 Alexander, 330 ft. S, 330 ft. W, NE cor., Sec. 27-20-8 ..... S.D. 2,200 ft.

Prairie O. & G. Co.'s No. 1 Shackelford, 561 ft. S, 321 ft. E, NW cor. SE NE, Sec. 30-23-5 ..... Derrick.

CONCORDIA PARISH

A. C. Glassell's No. 1 Pittsfield Plantation, N 9° E, 1,320 ft., SW cor., Sec. 41-8-10 ..... Drlg. lime 2,202 ft.

Joe Marr et al's No. 1 Maxwell, C, Sec. 35-3n-8e ..... S.D. 3,420 ft.

DE SOTO PARISH

Ark.-La. P. L. Co.'s No. 3 Johnson, 1,980 ft. N, 1,320 ft. W, SE cor., Sec. 1-11-14 ..... Coring lime 2,820 ft; D.S. test 2,794-2,806 ft; dry.

J. W. Clark's No. 1 Tidwell, 250 ft. S, 250 ft. E, NW cor. NW, Sec. 22-13-14 ..... D.S. test; small S.O. and G. 2,950 ft; dry; W.O.

S. A. Guy's No. 1 Dowling Bros., 469 ft. E, 382 ft. S, NW cor. NE, Sec. 31-14-14 ..... S.D; sandy shale 1,354 ft.

Bud Harrell's No. 1 Horton, 450 ft. E, 150 ft. N, SW cor., Sec. 4-11-11 ..... S.D. 1,060 ft.

Holly Oil Co.'s No. 1 Talbot (was Philp et al's, 220 ft. S, 730 ft. W, NE cor. NW NE, Sec. 9-13-13 ..... Cored lime, shale and sand 2,819 ft.

Keatchie O. & G. Co.'s No. 1 Hallie Smith (was H. E. Weichert's), NE SE, Sec. 31-14-15 ..... S.D. fuel, 1,470 ft.

C. D. Neff et al's No. 1 H. P. Dowling, 240 ft. N, 240 ft. W, SE cor., Sec. 18-13-14 ..... Rig up.

Odell & Lawton's No. 1 Tidwell-Tull, 300 ft. N, 600 ft. E, SW cor. NW, Sec. 11-13-14 ..... Cmtng. bottom; T.D. 3,004 ft.

NATCHITOCHES PARISH

W. M. Coats' No. 1 Collins, 730 ft. N, 50 ft. E, C, Sec. 28-9-10 ..... S.D. 3,600 ft.

J. W. Cooper et al's No. 1 Cooper, NW SW, Sec. 35-11-10. .. S.D; chalk 1,557 ft; arranging to reset liner and retest.

Cooper et al's No. 2-A Cooper, C SE SE, Sec. 32-11-10. .. Fishing 600 ft; D.S; T.D. 1,150 ft.

RED RIVER PARISH

Lucky Strike Oil Co.'s No. 1 Chaffraix, 200 ft. S, 200 ft. E, C, Sec. 33-12-10 ..... Coring 2,843 ft.

T. G. Shaw's No. 1 Wilkerson, 460 ft. N, 200 ft. W, SE SE, Sec. 4-12-10 ..... Bailer stuck with 700 ft. 38.5° oil in hole; T.D. 2,838 ft.

RICHLAND PARISH

Alto Gas Co.'s No. 2 Hunt, 660 ft. S and E, NW cor., Sec. 13-17-5 ..... Location.

W. C. Feazel's No. 1 Landrum, 620 ft. N, 4,573 ft. E, SW cor., Sec. 6-16-17 ..... Derrick.

Island Gas Co.'s No. 1 Noe, 1,902 ft. N, 660 ft. W, SE cor., Sec. 3-16-5 ..... Top Monroe gas rock 2,365 ft; bailed dry 2,419 ft. and 2,460 ft; D.S. test 2,479 ft., 2,509 ft. and 2,539 ft; S.W; 2,560-96 ft. S.W; S.D. 2,630 ft.

Pelican Nat. Gas Co.'s No. 1 Faust Bros., 1,980 ft. E, 660 ft. N, SW cor. NW, Sec. 13-17-5 ..... Began drlg. Oct. 29; cmtd. 12-in 170 ft; drlg. 792 ft.

SABINE PARISH

Boone trustee's No. 1 Turner, 40 ft. N, 140 ft. W, SE cor. NW NW, Sec. 4-7-11 ..... Rig up.

Tom David's No. 1 Smith, 460 ft. N, 200 ft. W, SE cor. SE SE, Sec. 27-8-10 ..... S.D. 1,550 ft.

Eylers O. & G. Co.'s No. 1 Frazier, 330 ft. S, 330 ft. W, NE cor. NW SW, Sec. 10-8-11 ..... Began drlg. Nov. 1; S.D. 30 ft.

Franks et al's No. 1 Dew, 200 ft. N, 300 ft. E, SW cor. SE, Sec. 32-8-11 ..... S.D. wtr. 1,325 ft.

R. L. Gay, tr.'s No. 1-A Sabine Lbr. Co., 212 ft. S, 170 ft. E, NW cor. SE NW, Sec. 1-7-12 ..... Derrick.

Troy-Jessup Oil Co.'s No. 1 Brown Lbr. Co. (was Lacey et al's), C NW NE, Sec. 28-8-10 ..... Began drlg. Oct. 28; cmtd. 10-in. 100 ft; drlg. 750 ft.

Lacey Prod. Co.'s No. 1 Cooper, 330 ft. N, 330 ft. E, SW cor. SW NE, Sec. 30-8-11 ..... Derrick.

Lide et al's No. 1 Ponder, 990 ft. N, 990 ft. W, C, Sec. 15-7-11 ..... Top marl 2,395 ft; cmtd. 6-in. 2,385 ft; T.D. 2,407 ft; tested dry 2,412 ft; 100 ft. oil in hole from 2,422 ft; D.S. test dry; W.O. 2,601 ft.

Lacey Prod. Co.'s No. 2 Cooper, 330 ft. N, 330 ft. W, SE cor. SW NW, Sec. 32-8-12 ..... Location.
D. M. Lide's No. 1 Sabine Lbr. Co., 330 ft. S, 330 ft. E, NW cor., Sec. 12-7-12 ..... Location.
Lohman & Walker's No. 1 Hubley, 330 ft. N, 330 ft. W, SE cor. SE NE, Sec. 21-7-11 ..... Top marl 2,461 ft; cmtd. 6-in. 2,465 ft.
Lohman et al's No. 1 Wyatt Lbr. Co., 150 ft. S, 330 ft. E, NW cor. NE SW, Sec. 18-4-11 ..... Rig up.
Longoria et al's No. 1 Belton, 330 ft. S, 330 ft. E, C, NE, Sec. 31-9-13 ..... Rig up.
Loring Oil Co.'s No. 13 Bowman-Hicks, 340 ft. N, 320 ft. W, SE cor. SW SE, Sec. 2-7-12 ..... Cmtd. 6⅝-in. 2,290 ft.
Magnolia Pet. Co.'s No. 1 Glauque, 484 ft. N, 990 ft. E, SW cor. NW SW, Sec. 26-7-14 ..... Drlg. hard lime 3,865 ft.
McDaniel & Lieber's No. 2 Batson, 480 ft. S, 320 ft. E, NW cor. SW SE, Sec. 16-8-13 ..... Did not set 6-in. 2,136 ft; drlg. 2,215 ft.
Merritt et al's No. 1 La. Long Leaf Lbr. Co., S½ NE NE, Sec. 33-8-11 ..... Drlg. 1,650 ft.
Paramount O. & G. Co.'s No. 1 Woolems, 330 ft. N, 330 ft. W, SE cor. NE NW, Sec. 11-6-12 ..... Drlg. 2,320 ft.
D. H. Riddick's No. 1 Scretchfield, 400 ft. E, 400 ft. N, SW cor. NW SE, Sec. 18-9-12 ..... Made 30-ft. hole 3,280-3,310 ft; S.D.
Sabine Synd.'s No. 1 G. Pence, 330 ft. N, 330 ft. E, SW cor. SE NW ..... Began drlg. Nov. 1; cmtd. 10-in. 100 ft.
Toteco Oil Co.'s No. 1 La. Long Leaf Lbr. Co., 325 ft. S, 100 ft. W, NE cor. NW, Sec. 18-6-12 ..... Reaming 3,795 ft; T.D. 4,077 ft.
R. B. Whittle's No. 1 Sabine Lbr. Co., 330 ft. N, 330 ft. E, SW cor. SE SW, Sec. 36-8-12 ..... Location.
Wilson & Son's No. 1 Ganby-Garrett, NW SW, Sec. 4-5-12 (portable rig) ..... U.R; T.D. 1,050 ft.

TENSAS PARISH

Seip et al's No. 1 Fowler, C SW NE, Sec. 10-10-10 ..... Drlg. soft sandy lime 570 ft.
A. R. Willis et al's No. 1 Currey, 1,320 ft. S, 1,320 ft. E, NW cor., Sec. 29-11-12 ..... S.D. 2,780 ft.

WEBSTER PARISH

Coyle, trustee's No. 1 Frazer, 200 ft. N, 200 ft. E, SW cor. NE SE, Sec. 27-23-11 ..... Derrick.

WEST CARROLL PARISH

Ark.-La. P. L. Co.'s No. 1 Griffith, 660 ft. S, 660 ft. W, NE cor. NE NW, Sec. 17-22-10 ..... D.S. test 2,794-2,818 ft; dry; drlg. hard chalk 2,820 ft.

ARKANSAS

CHICOT COUNTY

H. R. Smith's No. 1 Lytle, 660 ft. N, 660 ft. E, C, Sec. 31-18-3 ..... D.S. test 2,891-2,903 ft; dry; drlg. 2,910 ft.

CLAY COUNTY

S. C. Jeffries, trustee's No. 1 Underwood, 510 ft. N, 350 ft. W, C NW SE, Sec. 4-20-8 ..... Tested estimated 1,000,000 ft. gas 280 ft; S.D. 330 ft.

CLEBURNE COUNTY

Cosden Oil Co. of Ark.'s No. 1 Donophan, 100 ft. S, 660 ft. E, NW cor. SW SE, Sec. 19-9-10 ..... Milling on junk; T.D. 3,640 ft.
Donnelly-Craver et al's No. 1 Donophan Lbr. Co., SE cor. NW, Sec. 33-11-9 ..... S.D. repairing rig; T.D. 3,410 ft.

COLUMBIA COUNTY

J. W. Olvey et al's No. 1 Kate George, 200 ft. N, 245 ft. E, SW cor. NW SW, Sec. 29-18-20 ..... Drlg. 1,900 ft.

FRANKLIN COUNTY

Red Bank Oil Co.'s No. 1 Hamm, 660 ft. N, 660 ft. E, C, Sec. 33-10-6 ..... O.W.D.D; completed Oct. 8; estimated 6,500,000 ft. gas; 775 lbs. rock, 3,750 ft; fishing 3,750 ft.

GARLAND COUNTY

Givens et al's No. 1 Garrett, 660 ft. S, 660 ft. W, C, Sec. 1-8-19 ..... Drlg. lime 3,773 ft.

HOT SPRINGS COUNTY

Anisman et al's No. 1 Hinson est., NE NE, Sec. 19-4-16 (portable rig) ..... Drlg. 1,375 ft.
John Watkins' No. 1 Cunningham (was J. R. Lockhart's), 285 ft. S, 285 ft. W, NE cor., Sec. 11-5-16 ... Cmtd. 12½-in. 42 ft; drlg. 110 ft.

LAFAYETTE COUNTY

McIver et al's No. 1 Hottle, NW cor. NE, Sec. 1-20-6 ..... Rig up.

LINCOLN COUNTY

B. F. Thompson, trustee's No. 1 McGhee, 330 ft. S, 150 ft. W, C, Sec. 8-8-7 ..... Rigging up.

LITTLE RIVER COUNTY

A. L. Buck's No. 1 Greason, NW NW, Sec. 25-12-32 ..... S.D. 2,502 ft.

LOGAN COUNTY

Ark.-La. P. L. Co.'s No. 1 Jno. Jansen, 350 ft. S, 455 ft. E, NW cor. NE NE, Sec. 35-8-24 ..... Rig up.
J. H. Flowers' No. 1 J. H. White, Sec. 13-6-26 ..... U.R. 5 3/16-in. 3,570 ft; T.D. 3,610 ft.

MADISON COUNTY
(Cable tools)

J. W. Baxter's No. 2 Hallem, C, Sec. 17-16-26 ..... Drlg. 290 ft.

MILLER COUNTY

Bullock Oil Co.'s No. 1 Hervey, SE NE, Sec. 33-14-26 .... Drlg. 175 ft.
East Texas O. & G. Co.'s No. 1 Harvey, 500 ft. E, 300 ft. S, NW cor., Sec. 2-15-26 ..... 2-ft. sand 888 ft. dry; S.D; W.O. 900 ft.
E. & F. Oil Co.'s No. 1 E. L. Beck, 200 ft. S, 200 ft. E, NW cor. SW, Sec. 36-15-26 ..... D.S. test 2,804 ft; 500 bbls. S. W; 10 bbls. oil; flowed 125 bbls. fluid 10% oil, 2,814 ft; coring 3,910 ft.
Fitzwater et al's No. 1 Beck, 200 ft. N, 200 ft. W, SE cor. SW SE, Sec. 33-15-26 ..... Began drlg. Oct. 13; cmtd. 10-in. 93 ft.
Lenz et al's No. 2 Johnson, SE cor., Sec. 24-15-16 ..... Coring 3,100 ft.
Lenz et al's No. 3 Johnson, 250 ft. W, 150 ft. N, SE cor. NE NW, Sec. 24-15-26 ..... Began drlg. Nov. 3; cmtd. 10-in. 123 ft.
Salzer & McRae's No. 1 Rose, SW cor. NE NW, Sec. 9-16-26 ..... Began Drlg. Oct. 11; cmtd. 10-in. 98 ft.

GULF COAST FIELDS AND WILDCATS

(Continued from Page 68)

The Texas Company's No. 2 fee ..... Total depth 4,397 ft.; sidetracking 3,282 ft.
The Texas Company's No. 43 Stevenson, east ..... Sand and shale showing oil 4,746 ft.
Trapshooter Oil Co.'s No. 2 Rosenbaum ..... Drlg. sand and shale 3,974 ft.

PIERCE JUNCTION—HARRIS COUNTY

Gulf Prod. Co.'s No. 2 Manchester Corp. ..... Rig.
Mike Kouri's No. 1 Jones fee, northwest ..... Total depth 3,840 ft.; sidetracked to oil sand 3,650 ft.; cmtd. 6⅝-in. csg.
Rio Bravo Oil Co.'s No. 20-A Settegast ..... Total depth 5,550 ft.; sidetracking to oil sand 4,974 ft.; cmtd. csg.
Shaw et al's No. 2-B Fitzgerald (workover) ..... Set 1 joint screen 4,803 ft.; comp. flowing 500 bbls. daily.

BIG CREEK—FORT BEND COUNTY

Gulf Production Co.'s No. 61 Davis ..... Standing.
Navarro Oil Co.'s No. 5 Davis ..... Temporarily abandoned 4,428 ft.

LOST LAKE—CHAMBERS COUNTY

Pure Oil Co.'s No. 5 Lost Lake ..... Total depth 5,158 ft.; cmtd. 8⅝-in. csg. 5,505 ft.
Pure Oil Co.'s No. 12 Lost Lake ..... Cmtd. 10¾-in. surface csg. 987 ft.

NASH—BRAZORIA COUNTY

Rycade Oil Corp.'s No. 27 Wisdom ..... Total depth 5,662 ft.; fishing drill stem 4,833 ft.

SARATOGA—HARDIN COUNTY

Rio Bravo Oil Co.'s No. 100-A Cotton ..... To pump 539 ft.
Rio Bravo Oil Co.'s No. 100-B Cotton ..... Comp. flowing 17 bbls. 150 ft.
Rio Bravo Oil Co.'s No. 102-A Cotton ..... Rig.

GOOSE CREEK—HARRIS COUNTY

Humble Oil & Ref. Co.'s No. 78 Simms-Smith ..... Shale 4,993 ft.; making repairs.

SPINDLETOP—JEFFERSON COUNTY

Battleship Oil Co.'s No. 3 Parker ..... Shut down 2,778 ft.
Yount Lee Oil Co.'s No. 72 McFaddin ..... Salt water 5,066 ft.; pulling liner and screen.
Yount Lee Oil Co.'s No. 142 McFaddin ..... Tested salt water 5,544 ft.; abd.
Yount Lee Oil Co.'s No. 143 McFaddin ..... Drlg. shale and lime 5,030 ft.
Yount Lee Oil Co.'s No. 144 McFaddin ..... Drlg. shale and lime 4,555 ft.

NORTH DAYTON—LIBERTY COUNTY

Saxet Oil Co.'s No. 2 Davis ..... Drlg. gumbo and lime 4,643 ft.
Harrison & Abercrombie's No. 1 Jones ..... Drlg. sand 4,635 ft.
Harrison Oil Co.'s No. 4 Quintette (workover) ..... Drlg. hard sand and lime 4,621 ft.
Harvey Smith's No. 1 Kynerd ..... Location.

HIGH ISLAND—GALVESTON COUNTY

Gulf Prod. Co.'s No. 10 Smith ..... Drlg. sand and lime 5,657 ft.
Mars McLean's No. 19 Cade ..... Drlg. sand and shale 2,788 ft.
Marrs McLean No. 20 Cade ..... Location.

LIBERTY—ORANGE COUNTY

Empire Gas & Fuel Co.'s No. 14 O'Brien ..... Drlg. rock 3,826 ft.
Trinity Petroleum Co. No. 1 C. W. Pickett ..... Oil sand 3,420 ft.; cmtd. csg.

ORANGE—ORANGE COUNTY

Gulf Prod. Co.'s No. 12 Hagen-Moore ..... Drlg. 2,966 ft.
Orange Pet. Co.'s No. 13 Chesson ..... Casing collapsed 2,150 ft.

HULL—LIBERTY COUNTY

The Texas Company's No. 3 Barrow ..... Set screen 4,110 ft.; comp flowing 1,000 bbls. through drill stem and ⅜-in. choke.

PORT NECHES—ORANGE COUNTY

Gulf Prod. Co.'s No. 1 W. E. Starks ..... Drlg. sand 6,973 ft.
The Texas Company's No. 2 Starks ..... Drlg. sand 6,044 ft.

CLAY CREEK—WASHINGTON COUNTY

Sun Oil Co.'s No. 4 Janner ..... Drlg. hard sand 2,988 ft.
Sun Oil Co.'s No. 1 Freeman ..... Drlg. sand and shale 1,662 ft.

SOUR LAKE—HARDIN COUNTY

The Texas Company's No. 307 fee ..... Fishing bit 2,797 ft.

ESPERSON COUNTY

Cranfill-Reynolds' No. 9 Esperson ..... Junked and abandoned 1,850 ft.
Cranfill-Reynolds Oil Co.'s No. 17 Esperson ..... Total depth 3,951 ft.; sidetracking 2,045 ft.
Cranfill-Reynolds Oil Co.'s No. 1 Vajdak (workover) .... Total depth 7,592 ft.; sidetracking in shale 2,148 ft.
Cranfill-Reynolds Oil Co.'s No. 6 Moore's Bluff ..... Drlg. surface formation 100 ft.
Cranfill-Reynolds Oil Co.'s No. 7 Moore's Bluff ..... Rig.
Yount Lee Oil Co.'s No. 3 Moores Bluff ..... Drlg. shale 7,709 ft.

HANKAMER—LIBERTY COUNTY

Gulf Prod. Co.'s No. 1 Ezzel ..... Drlg. oil sand 5,406 ft.

WEST COLUMBIA—BRAZORIA COUNTY

The Texas Company's No. 80 Hogg (workover) ..... Drlg. sand showing oil 2,735 ft.

BOLING—WHARTON COUNTY

C. S. Thomas' No. 1 Volney ..... Drlg. shale 511 ft.

REFUGIO—REFUGIO COUNTY

Brookins et al's No. 1 Kay ..... Shut down 4,320 ft.
Houston Oil Co.'s No. 1 Rooke ..... Coring shale 6,216 ft.
Houston Oil Co.'s No. 2-A Fannie Heard ..... Drlg. hard lime 3,743 ft.
Houston Oil Co.'s No. 1 Doughty ..... Sidetracking 4,960 ft.
Houston Oil Co.'s No. 1 Tom Heard ..... Pulling tubing 5,470 ft.
Houston Oil Co.'s No. 1 O'Connor ..... Plugged to 2,524 ft.
Houston Oil Co.'s No. 1-A Rose Lambert ..... Oil sand 5,901 ft.; cmtd. 6⅝-in.
Independent Oil & Gas Co.'s No. 1 Rose Lambert ..... Drlg. plug 6,461 ft.
Independent Oil & Gas Co.'s No. 6 Jerry Reilly (workover) ..... 700 lbs. dry gas shut in 3,637-59 ft.
Independent Oil & Gas Co.'s No. 1 Mercy Academy, (workover) ..... 2,300 lbs. dry gas 6,423 ft.
Edwin Jones' No. 1 Mitchell ..... Oil sand 5,433 ft.; shale 5,441 ft.
Luling Oil & Gas Co.'s No. 1 Talman, Blk. 104 ..... Drlg. shale 6,204 ft.
Luling Oil & Gas Co.'s No. 1 J. W. Kay ..... Standing 4,928 ft.
Luling Oil & Gas Co.'s No. 1 City, Lot 16, Block 4 ..... Rig.
Mission Drilling Co.'s No. 1 Ben Shelton ..... Oil sand 6,445-50 ft.; swabbing.
Mission Drilling Co.'s No. 1 O'Brien (workover) ..... Standing 5,471 ft.
Moody-Seagraves Prod. Co.'s No. 1 Linney, Blk. 41 ..... Standing cemented 4,356 ft.
Moody-Seagraves Prod. Co.'s No. 1 Linney, Blk. 42 ..... Abandoned 4,880 ft.
Moody-Seagraves Prod. Co.'s No. 1 Rooke ..... Drlg. hard shale 6,301 ft.
Moody-Seagraves Prod. Co.'s No. 1-A St. John ..... Drlg. shale 5,882 ft.
Moody-Seagraves Prod. Co.'s No. 1 Strauch, Blk. 65 ..... Set liner and screen 6,451 ft.
Moody-Seagraves Prod. Co.'s No. 5 Morgan-O'Connor ..... Set screen 5,756 ft.
Moody-Seagraves Prod. Co.'s No. 6 Morgan-O'Connor ..... Drlg. gumbo 450 ft.
Moody-Seagrave's Prod. Co.'s No. 1 Tom Heard, Blk. 3. Set 15 ft. screen 6,469 ft.; swabbing.
Nichols Oil Co.'s No. 1 Wood ..... Shut down 1,400 ft.
Ed Price's No. 2 Mission River ..... Standing 3,665 ft.
Pearson Properties, Inc.'s No. 1 Hornburg ..... Derrick.
Royal Oil Co.'s No. 1 Hornburg (workover) ..... Oil sand 5,049 ft.; fishing drill stem.
Saxet Oil Co.'s No. 1 L. H. Johnson, Blk. 11 ..... Location.
Saxet Oil Co.'s No. 1 Fox heirs (workover) ..... Total depth 3,963 ft.; setting up larger rig.
Saxet Oil Co.'s No. 12 Clint Heard (workover) ..... Sand 6,383 ft.; shut down for repairs.
Saxet Oil Co.'s No. 1 Ryals (workover) ..... Total depth 5,486 ft.; drlg. shale 4,931 ft.
Sun Oil Co.'s No. 3 Rea ..... Drlg. hard shale and lime 1,306 ft.
L. L. Smith's No. 1 Powers, Blk. 85 ..... Drlg. hard sticky shale 6,105 ft.
L. L. Smith's No. 1 Rodgers ..... Derrick.
Union Producing Co.'s No. 11 Fannie Heard ..... Drlg. sticky shale 3,220 ft.
Union Prod. Co.'s No. 3 Fox ..... Drlg. oil sand 3,631 ft.
Union Prod. Co.'s No. 5 Powers ..... Drlg. sticky shale 3,580 ft.

SOUTH LOUISIANA FIELDS

LOCKPORT—CALCASIEU PARISH

Union Sulphur Co.'s No. 1 Martha Moss ..... Drlg. rock 6,792 ft.
Vacuum Oil Co. and Gulf Ref. Co.'s No. 28 Miller ..... Drlg. shale 5,482 ft.
Vacuum Oil Co.'s No. 30 Miller ..... Gumbo 1,277 ft.; cmtd. 13⅜-in. csg. 1,252 ft.
Vacuum Oil Co.'s No. 31 Miller ..... Location.
Vacuum Oil Co.'s No. 6 Bayou State ..... Cemented casing 4,415 ft.
Yount Lee Oil Co.'s No. 1 Miller ..... Total depth 7,764 ft.

EDGERLY—CALCASIEU PARISH

Rex Petroleum Co. No. 13 Hunter ..... Drlg.

HACKBERRY—CAMERON PARISH

Calcasieu Oil Co.'s No. 2 Landry ..... Drlg. gumbo 1,742 ft.
Calcasieu Oil Co.'s No. 1 State ..... Drlg. shale and lime 3,728 ft.
Calcasieu Oil Co.'s No. 22 Watkins ..... Drlg. shale 1,936 ft.
R. E. Seiss' No. 1 Vincent ..... Drlg. gumbo 1,961 ft.
The Texas Company's No. 7 State ..... Drlg. heaving shale 5,049 ft.
The Texas Company's No. 8 State ..... Location.
Yount Lee Oil Co.'s No. 32 State Land ..... Oil sand 3,903-09 ft.; comp. flowing 650 bbls. net oil, ⅝-in. choke.
Yount Lee Oil Co.'s No. 33 State ..... Drlg. gumbo 2,205 ft.
Yount Lee Oil Co.'s No. 34 State ..... Location.
Yount Lee Oil Co.'s No. 35 State ..... Drlg. sticky shale 1,989 ft.
The Texas Company's No. 26 State ..... Location.
The Texas Company's No. 27 State ..... Location.
The Texas Company's No. 28 State ..... Location.
The Texas Company's No. 39 State ..... Location.
The Texas Company's No. 40 State ..... Location.

JENNINGS—ACADIA PARISH

Yount Lee Oil Co.'s No. 9 Housierre Latrielle ..... Drlg. shale 8,227 ft.

VINTON—CALCASIEU PARISH

Edgerly Pet. Co.'s No. 2 McLean ..... Total depth 3,247 ft.; pulling screen set at 2,987 ft. after testing salt water.
Gulf Ref. Co.'s No. 69 G.&N.G. (workover) ..... No report.
Gorbat Oil Co.'s No. 1 Clement Lyons ..... Bailed dry 4,040 ft.; pulling screen.
Lucky Ten Oil Co.'s No. 1 Lizzo ..... Shut down 3,326 ft.
Vinton Pet. Co.'s No. 2 Gray (workover) ..... Drlg. gumbo 3,253 ft.
Vinton Petroleum Co.'s No. 10 Gray ..... Drlg. gumbo and lime 3,520 ft.
Wilson-Broach's No. 3 Wilson (workover) ..... Drlg. gumbo 3,592 ft.

BAYOU BOUILLON—ST. MARTIN PARISH

Rycade Oil Corp.'s No. 1 Woodyard Lake ..... Fishing drill stem 6,085 ft.
Rycade Oil Corp.'s No. 4 State ..... Total depth 4,153 ft.; reaming.

STARKS—CALCASIEU PARISH

I. O. Davis' No. 1 Industrial ..... Shut down 6,176 ft.

SORRENTO—ASCENSION PARISH

Gulf Ref. Co.'s No. 7 United Land Co. (workover) ..... Drlg. salt 2,227 ft.

SWEET LAKE—CAMERON PARISH

Pure Oil Co.'s No. 10 Yount Lee ..... Spudded.

SULPHUR—CALCASIEU PARISH

Union Sulphur Co.'s No. 745 Fee (workover) ..... Drlg. 3,812 ft.
Union Sulphur Co.'s No. 763 Fee ..... Drlg. gumbo 3,023 ft.
Union Sulphur Co.'s No. 764 Fee ..... Salt 4,740-45 ft.; sidetracked 4,296 ft. to test shallower sand.

MISCELLANEOUS WILDCATS

TEXAS

AUSTIN COUNTY

Empire Gas & Fuel Co.'s No. 1 Kuntze, San Felipe ..... Drlg. shale 4,665 ft.
O'Hara et al's No. 1 Schrader ..... Shut down for fuel 1,794 ft.

BRAZORIA COUNTY

The Texas Company's No. 1 Ewin, Harvey Little Sur. ... Drlg. sand and shale 7,467 ft.
The Texas Company's No. 1 J. H. Murdock, Fresno ..... Drlg. sand and shale 5,494 ft.
Mills Bennett Prod. Co.'s No. 2 Reece, Allen ..... Drlg. rock 1,396 ft.
Mills Bennett Prod. Co.'s No. 2 Random, Allen ..... Location.
Mills Bennett Prod. Co.'s No. 2 Allen ..... Total depth 5,187 ft.; reaming.
Mills Bennett Prod. Co.'s No. 1 Poole (workover) ..... Pulled liner 4,374 ft.
Faust et al's No. 5 Faust ..... Drlg. sand 5,549 ft.
Freeport Sulphur Co.'s No. 2,001 fee, Bryan Heights ..... Total depth 4,261 ft.; sidetracking shale and lime 3,015 ft.
Freeport Sulphur Co.'s No. 2 Seaburn ..... Rig.
Freeport Sulphur Co.'s No. 1 Tolar, Stratton Ridge ..... Drlg. sand rock 1,352 ft.
Layne et al's No. 7-A Wisdom, Damon Mound ..... Drlg. hard sandy lime 1,899 ft.
Rycade Oil Corp.'s No. 2 Seaburn, Stratton Ridge ..... Drlg. shale 3,487 ft.
Steel & Strickland's No. 1 Lockbridge ..... Spudded and shut down.
United Oil Syndicate's No. 1 Speer, A. A. Talmadge Sur... Drlg. surface formation 59 ft.

CALHOUN COUNTY

The Texas Company's No. 1 Thomas, J. P. Tilley Sur. ... Drill stem stuck 5,956 ft.

CHAMBERS COUNTY

Chicago Oil Corp.'s No. 1 Lawrence ..... Drlg. sand and shale 4,091 ft.
Shell Pet. Corp.'s No. 3 Herff, Moss Bluff ..... Drlg. hard shale and lime 5,580 ft.

GRIMES COUNTY

Cullen & West's No. 1 Bookman, J. Greenwood Sur..... Drlg. gumbo 1,017 ft.
Deering et al's No. 1 Munker, Darius Gregg Sur. ..... Drlg. hard shale 3,212 ft.
Deering & Noble's No. 1 Templeton, 6 miles south of Navasota ..... Shut down 3,500 ft.

HARDIN COUNTY

D. O. Speight's No. 1 fee, near Batson ..... Shut down 2,857 ft.

HARRIS COUNTY

Gulf States Oil Co.'s No. 1 Angsperger ..... Drlg. gumbo 2,694 ft.
Harrison & Abercrombie's No. 1 Gerring, Mykawa..... Location.
Humble Oil & Ref. Co.'s No. 3 Warren, Hockley ..... Drlg. shale 5,557 ft.
Humble Oil & Ref. Co.'s No. 4 Minnetex, Mykawa ..... Drlg. sand 50 ft.
Golden State Oil Co.'s No. 1 McDade, N. Brady Sur. ..... Drlg. shale 5,115 ft.
W. C. Turnbow et al's No. 1 Miller, Arthur McCormick Sur. ..... Drlg. water sand 2,723 ft.

JACKSON COUNTY

Jackson County Oil Syndicate's No. 3 Drushell, Edna .... Gas sand 3,866-70 ft.; cmtd. 6⅝-in csg. 3,864 ft.
Wright Bros.' No. 2 Lee ..... Drlg. shale and lime 3,946 ft.
Warner-Quinlan's No. 1 Hungerford, Henry Smith Sur. ... Location.

JEFFERSON COUNTY

Humble Oil & Ref. Co.'s No. 1 McFaddin, T.&N.O. Sur. 234.. Building road to location.
The Texas Company's No. 4 Pipkin, Big Hill ..... Drlg. rock 2,975 ft.

LIBERTY COUNTY

Hamm et al's No. 1 Harvard, Davis Hill ..... Drlg. surface formation 112 ft.
Humble Oil & Ref. Co.'s No. 1 Breeding, Moss Bluff .... Drlg. shale and lime 5,916 ft.
Humble Oil & Ref. Co.'s No. 1 Orlando Hylton, Moss Bluff ..... Total depth 6,352 ft.; set 9⅝-in. casing.
Humble Oil & Ref. Co.'s No. 1 Sergent, Moss Bluff ..... Drlg. hard sand and lime 5,385 ft.
Rycade Oil Corp.'s No. 1 Heiskell ..... Abandoned sticky shale 5,927 ft.

MATAGORDA COUNTY

H. C. Cockburn's No. 2 Hawkins, Shepherds Mott ..... Drlg. shale 4,512 ft.
Empire Gas & Fuel Co.'s No. 1 Baker, Citrus Grove ..... Drlg. hard sandy lime 5,982 ft.

MONTGOMERY COUNTY

Lake Creek Oil Co.'s No. 1 Hunt, south of Conroe ..... Shut down 1,350 ft.
Price & Whitehead's No. 2 Guerges ..... Shut down 2,956 ft.

NACOGDOCHES COUNTY

E. L. Burke et al's No. 1 Latimer, Jose De Los Santos Sur. ..... No report.

REFUGIO COUNTY

Blanco Oil Co.'s No. 1 Dorman ..... Shut down 3,120 ft.

SAN JACINTO COUNTY

E. P. Edwards et al's No. 1 Bennett, northwest of Cold Springs ..... Rig.

VICTORIA COUNTY

Houston Oil Co.'s No. 1 McFaddin, C. O. Edwards Sur. .. Shut down 4,641 ft.
The Texas Company's No. 1 McFaddin, H. Bonny Sur. ... Drlg. hard white sand 5,957 ft.
Lion Oil & Ref. Co.'s No. 2 McFaddin, M. Travers Sur... Fishing drill stem 6,454 ft.
Newton et al's No. 1 West ..... Shut down 1,550 ft.

WHARTON COUNTY

H. H. Given's No. 1 Hudgins, near Hungerford ..... Drlg. gumbo 590 ft.

SOUTH LOUISIANA

CALCASIEU PARISH

Crawford Doyle's No. 1 Johnson, Sec. 23-9s-13w ..... Shut down temporarily 312 ft.
J. O. Davis' No. 1 Industrial, Sec. 29-9s-10w ..... Drlg. chalk 6,185 ft.
Wilfred Lahay's No. 1 Jardell, Sec. 16-10s-12w ..... Derrick.
Dr. Thomas et al's No. 1 John Hewitt ..... Location.
Vacuum Oil Co.'s No. 1 Walt, Iowa ..... Derrick.

CAMERON PARISH

Shell Petroleum Corp. No. 2 State, Black Bayou..... Location.
Shell Petroleum Corp.'s No. 16 Watkins, Black Bayou.... Location.
Vacuum Oil Co.'s No. 1 Cameron Meadows, Sec. 21-14s-13w ..... Total depth 5,248 ft.; sidetracked 5,195 ft.; drill stem stuck.
The Texas Company's No. 6 State, Calcasieu Lake ..... Cap rock 1,978 ft.; cmtd. 9⅝-in. casing.
The Texas Company's No. 7 State, Calcasieu Lake..... Location.

IBERIA PARISH

The Texas Company's No. 6 Vermillion Bay ..... Driving piling.

IBERVILLE PARISH

Gulf Ref. Co.'s No. 1 Gay, Bayou Choctou ..... Spudded and shut down.
Shell Pet. Co.'s No. 5 Wilbert, White Castle ..... Drlg. hard sandy lime 4,368 ft.
Standard Oil Co.'s No. 7 Wilbert, Bayou Blue ..... Derrick.
Standard Oil Co.'s No. 8 Wilbert, Bayou Des Glaise ..... Fishing; stuck drill stem 3,640 ft.
Standard Oil Co.'s No. 1 E. B. and S. P. Schwing, Bayou Blue ..... Drlg. hard sand 4,257 ft.
Standard Oil Co.'s No. 1 Saint Cooperage, Bayou Blue .. Bldg. derrick.

JEFFERSON PARISH

Humble Oil & Ref. Co.'s No. 1 Delaware, Sec. 2-14s-23e.. Drlg. shale 6,712 ft.

JEFFERSON DAVIS PARISH

H. T. McClain et al's No. 1 Trimble Atterbury, Welsh, Sec. 16-9s-5w ..... Rigging up.
Vacuum Oil Co.'s No. 1 Tietje, Roanoke ..... Setting up.

LA FOURCHE PARISH

The Texas Company's No. 1 L.L.&F., Leesville ..... Abandoned 5,616 ft.

PLAQUEMINE PARISH

Gulf Ref. Co.'s No. 2 Buras Levee Board ..... Location.
Humble Oil & Ref. Co.'s No. 2 Cockrell-Moran, Lake Grand Ecaille ..... Cavity 1,057 ft.
The Texas Company's No. 4 State, Garden Island ..... Fishing drill stem 4,414 ft.
The Texas Company's No. 5 State, Garden Island ..... Location.

ST. JAMES PARISH

Convent Oil Co.'s No. 2 Uncle Sam, Sec. 28-11s-4e ..... Set screen 1,834 ft.; shut down.

ST. MARTIN PARISH

The Texas Company's No. 3 Iberville Land ..... Location.
The Texas Company's No. 4 St. Martin, Hager ..... Derrick.
The Texas Company's No. 5 St. Martin, Hager ..... Derrick.

ST. TAMMANY PARISH

Washington-St. Tammany's No. 2 Caussack, Sec. 5-6s-10e ..... Drlg. gumbo 989 ft.

TERREBONNE PARISH

Louisiana Gas & Fuel Co.'s No. 9 Manor, Houma ..... Set 12½-in. casing 1,324 ft.
The Texas Company's No. 1 L.L.&E., Bay St. Elaine .... Derrick.
The Texas Company's No. 5 State, Bay St. Elaine ..... Rig.
The Texas Company's No. 4 State, Caillou Island ..... Location.
The Texas Company's No. 5 State, Caillou Island ..... Drlg. cap rock 4,024 ft.
The Texas Company's No. 6 State, Bay St. Elaine ..... Location.
The Texas Company's No. 3 State, Dog Lake ..... Drlg. hard sand 5,477 ft.
The Texas Company's No. 4 La. L. & E., Four Isle ..... Shut down for fuel 6,131 ft.
The Texas Company's No. 2 La. L. & E., Bay Junop ..... Drlg. shale and lime 5,731 ft.
The Texas Company's No. 6 State, Lake Pelto ..... Derrick.
The Texas Company's No. 6 State, Lake Barre ..... Location.
The Texas Company's No. 7 State, Lake Barre ..... Derrick.
The Texas Company's No. 8 State, Lake Barre ..... Derrick.
The Texas Company's No. 9 State, Lake Barre ..... Location.

WEST FELICIA PARISH

Putnam Syndicate's No. 1 Como Plantation, Sec. 51-1e-4w ..... Total depth 3,738 ft.; fishing stuck drill stem.

WILDCAT OPERATIONS IN SOUTHWEST TEXAS

(Continued from Page 66)

BEE COUNTY

William F. Morgan and Independent Oil & Gas Co.'s No. 1 Quincy, C Blk. 9 of 11,000-ac. Quincy Subd. of Bee County ..... T. D. 5,520 ft.; drlg.
O'Neal & Catlett's No. 1 Pat Pugh ..... Location.
Hurlbut et al's No. 1 Mrs. D. Chestnut ..... T. D. 4,320 ft.; shut down repairing boiler.
Walter Rawlins' No. 1 P. L. Campbell, C B.&B. Sur. .... T. D. 3,000 ft.; drlg. stick shale.
E. S. Price's No. 3 Weiss, 900 ft. due NE of No. 1 Weiss.. Location.
E. S. Price's No. 2 Weiss, 900 ft. due SW of No. 1 Weiss, B.&B. Sur. ..... T. D. 4,418 ft.; cored sand 4,411-18 ft.; preparing to test.
Moody-Seagraves Producing Co.'s & Independent Oil & Gas Co.'s No. 1 Welder, 6,280 ft. from S line, 3,150 ft. from E line of Welder tract, Henry Eyles Sur. ..... T. D. 30 ft.; working on water well.
Cosden Oil Co.'s No. 1 Stoltzfus, 2,310 ft. S and E lines of Sec. 14, Rangley Subd. of C. Miller ranch, Uranga Sur. ..... T. D. 4,290 ft.; pulling liner to deepen.
Humble and Hurlbut et al's No. 1 J. C. Wood, 150 ft. from NW line, 1,144 ft. from SW line of P. T. Irrigation Co. ..... T. D. 5,077 ft.; standing.
The Texas Company's No. 1 McCampbell, 150 ft. from N and E lines of 161-ac. tract, R. Pena Sur. ..... Location.
E. S. Price's No. 1 Weiss, 200 ft. each way out of NW cor. of B. & B. Sur. ..... T. D. 4,418 ft.; cored sand 4,411-18 ft.; preparing to test.
Rowan and Hope's No. 1 Goree, 600 ft. S. 200 ft. W. Lot 4, T. B. Barton Sur. ..... Rigging up.

BEXAR COUNTY

Eckert & Son's No. 3 J. J. Brehm, 545 ft. from N line, 150 ft. from W line of lease, Sur. No. 58 ..... Location.
Gatlin Oil Co.'s No. 2 I. A. Beck, 150 ft. from SE line, 2,551 ft. from SW line of lease, J. Montez Sur. ..... Location.
Humble Oil & Ref. Co.'s No. 1 Ernest Lamm, near Elmendorf, southern part of county ..... Moving in machinery.
Long and Craig's No. 1 Sandemer ..... Location.
K. M. S. Pet. Co.'s No. 1 E. Salicky, 132 ft. from E line, 10 ft. S line of tract, Blk. 15, Mission Gardens ..... T. D. 980 ft.; drlg. gumbo.
J. M. Russell's No. 1 F. L. Price, 1,500 ft. to N line, 660 ft. W of tract in Angel Navarro Sur. ..... T. D. 206 ft.; changing rig.
Snyder, Reeves et al's No. 2 Glasscock, 12 miles NE of San Antonio ..... T. D. 300 ft.; drlg.
Weibacher et al's No. 1 Ernst, 6,400 ft. S line, 900 ft. W line of J. Christopher Sur. ..... T. D. 720 ft.; drlg. plugs.
Penn Oil Co.'s No. 1 Kosub, 600 ft. N of NE cor. of Cooksey tract, then 700 ft. E on 175-ac. tract, J. Riall Sur. ..... T. D. 1,054 ft.; took 18-ft. core; showed saturated sand.
Somerset Syndicate's No. 1 Lagrange, 54 varas from S and W lines of Carrico tract, Sur. No. 48 ..... T. D. 375 ft.; shut down.
I. L. Dingman's No. 2 Cassin, 45 varas from N line, 378 varas from E line, Rodriguez Sur. ..... T. D. 1,602 ft.; dry and abnd.
J. E. Weatherall and Ben C. Hilman's No. 1 Talley .... Location.
Russell and Moore's No. 2 Mills, 20 ft. S of No. 1, Angel Navarro Sur. ..... T. D. 980 ft.; drlg. broken lime.
F. W. Tong's No. 1 Willie Sandemer, 150 ft. from NE and SE lines of the N 20 acres of Willie Sandemer 400-ac. tract, Juan Montez Sur. ..... Rigging up.
Bowman and Waldrop's No. 1 Ridder, 1,000 ft. from S and W lines of 688-ac. tract, J. M. Sur. ..... T. D. 1,934 ft.; reaming at 730 ft
L. H. Wentz' No. 1 W. D. Myrick, 150 ft. W of CEL of 118-ac. tract, B. Lockhart Sur. ..... Location.

CALDWELL COUNTY

Callihan et al's No. 3 W. H. Callihan, 70 ft. N, 65 deg. E of No. 2 ..... Location.
Callihan et al's No. 4 W. H. Callihan, 2,000 ft. from N line, 1,945 ft. from W line of tract, John R. Miller Sur. ..... T. D. 2,232 ft.; drlg.
W. D. Anderson's No. 1 Vickery, 150 ft. from N line, 450 ft. from W line of farm, Damon Sur. ..... Derrick.
Cargil et al's No. 1 Thomas, 1,505 ft. from E line, 150 ft. from NE cor. of A. W. Jordan tract, J. Roberts Sur. ..... Rigging up.
Blount and Mills' No. 1 McMahan, 275 ft. from SW line, 75 ft. from SE line of 50-ac. tract, J. Pinchback Sur. ..... T. D. 1,050 ft.; cratered around surface csg. from gas blowout; trying to recement.

CALHOUN COUNTY

The Texas Company's No. 1 Thomas in the J. D. Tilly Sur. ..... T. D. 5,904 ft.; fishing for drill stem.

COLORADO COUNTY

Lewis Siagel Drilling Co.'s No. 1 Henderson, 990 ft. from W line, 2,310 ft. from S line, Sec. 1, Blk. 57, T.&P. Sur. ..... Location.

COMAL COUNTY

Caldwell & Lanier's No. 1 T. J. Byler, 175 varas from W line, 370 varas from N line of 320-ac. tract in the H.E.&W.T. No. 5,894 Sur. ..... T. D. 600 ft.; shut down for csg.
New Braunfels Oil & Gas Co.'s No. 1 Adolph Seidemann, 269 ft. to NE line, 470 ft. to NW line of farm in the A. M. Esnpuricals 11-League Sur., 1 mile SE from New Braunfels ..... T. D. 2,329 ft.; drlg.; small show oil and gas 2,210-18 ft.

DEWITT COUNTY

Penn Oil Co.'s No. 1 Junker, center N half 20-ac. tract, Pettus Sur. ..... T. D. 3,326 ft.; making drill stem test.
H. T. Roe's No. 1 Leinhardt ..... T. D. 2,170 ft.; shut down.
A. H. Gibson et al's No. 1 Von Roeder, 750 ft. N line, 200 ft. E line of farm, W. G. Hill League ..... T. D. 2,350 ft.; drlg.; topped Jackson 2,285 ft.
Sheldon Petroleum Co.'s No. 1 Goehring, center of Goehring tract, H. Stubblefield Sur. ..... Location.

DUVAL COUNTY

Sloan et al's No. 1 Luby, SW cor. of Sur. 593 ..... Location.
S. R. C. Oil Co.'s No. 1 Duval County Land Co., Sur. 280 ..... Rigging up.

EDWARDS COUNTY

Phillips Pet. Corp.'s No. 2 A. G. Holman, 320 ft. from N and E lines of SE of tract, C.C.S.D.&N.G.R.G. Sur. No. 25 ..... T. D. 6,325 ft.; fishing for bailer.
James Dalgish's No. 2 Peterson, 850 ft. N line, 1,100 ft. W line of Sec. 82, Blk. E in the H.E.&W.T. Sur. .. Location.
James Dalgish-Morrow's No. 1 Peterson, NW cor. Sec. 82, Blk. E, H.E.&W.T.R.R., NE cor. of county in the H.E.&W.T.R.R. Sur. ..... T. D. 4,775 ft.; drlg. white lime.

FRIO COUNTY

A. H. Wray's No. 1 Burns estate, 700 ft. N, 330 ft. E of C Sec. 123, Antone Hupzor ..... T. D. 2,606 ft.; drlg. in shale.

GOLIAD COUNTY

A. G. Riemenschneider's No. 1 A. T. Fromme, 275 ft. from N line, 912 ft. W line of 300-ac. tract, P. Dexeter Sur. ..... T. D. 2,330 ft.; shut down.
Gibson Oil Co.'s No. 1 Cyrus Parks, 3,000 ft. S and 2,500 ft. E of NW cor. of Parks ranch, Ferguson Sur. ..... T. D. 4,430 ft.; drlg.
T. B. Slick's No. 1 Poetker, 1,500 ft. from SW line, 900 ft. from SE line of 591-ac. tract, Obid Marshall Sur ..... T. D. 1,700 ft.; drlg.
Union Prod. Co.'s No. 29 Ray, 450 ft. from N, 275 ft. from W lines of A.B.&M. Sur. ..... T. D. 4,198 ft.; cored sand 4,190-98 ft.; will make drill stem test.

GONZALES COUNTY

Mardon Oil Co's No. 1 Borrer, 150 ft. N and W in the James Stewart Sur., 5 miles NW from Waelder ..... T. D. 1,850 ft.; abnd.
Mardon Oil Co's No. 1 Robinson ..... T. D. 3,284 ft.; waiting for orders.
United North & South Dev. Co.'s No. 2 Preston, 1,050 ft. NE. 450 ft NW of upper S or SW cor. of Oethkin one-third league, 900 ft. SE of Preston No. 1.... Location.
Linden Petroleum Corp.'s No. 1 Hensley, 650 ft. from N line, 1,110 ft. from W line Hensley tract, J. Smith Sur.; reinstated ..... T. D. 4,811 ft.; bailing
A. J. Keiffer et al's No. 1 B. B. Dix, 550 ft. W of E line, 2,775 ft. N of S line (Guadalupe River) in the Ira Nash Sur., 4 miles SE from Darst Creek ..... T. D. 2,920 ft.; shut down.
Andibus & Cummings' No. 1 R. D. & J. C. Miller, 523 ft. from S line, 1,000 ft. from E line, Ann Williams Sur. ..... T. D. 2,409 ft.; drlg.; show oil 2,385-96 ft. in sand.
Acme Oil & Royalty Corp.'s No. 1 H. K. Weber, 2,525 ft. from NW line, 2,250 ft. from SW line, Wright Sur. ..... T. D. 2,395 ft.; corrected; reaming
United North and South Development Co.'s No. 1 Wells, 450 ft. each way out of NW cor. of Wells tract, Johnson League ..... T. D. 1,935 ft.; drlg.

GUADALUPE COUNTY

J. S. Suttle's No. 2 A. Baenzinger, 40 ft. E line, 150 ft. S line of tract in the A. O. Mansola Sur., 5½ miles S from Seguin ..... T. D. 1,954 ft.; swabbed oil.
Ray Oil Co.'s No. 1 R. Feising, 300 ft. NW line, 450 ft. NE line 120-ac. tract in the M. Baker Sur. ..... T. D. 900 ft.; shut down.
J. S. Suttle's No. 1 Wurzbach, 3,750 ft. from NW line, 2,450 ft. from NE line of Young Settoon Sur. ..... T. D. 40 ft.; set 10-in. csg.
O. K. Emerson's No. 1 C. A. Phillips, center of 80-ac. tract, Velda Sur. ..... Derrick.
Jones and Erwin's No. 1 O. Forrester, 2,700 ft. from NE cor., 450 ft. from NW line, O. Forrester tract, Pate Sur. ..... T. D. 707 ft.; shut down.
Jones and Erwin's No. 1 Hoese, 150 ft. each way out of NE cor. of 200-ac. tract, J. Leal Sur. ..... T. D. 175 ft.; drlg.
Adams and Lyles' No. 1 Seligman, 150 ft. from E line, 300 ft. from S line of 462-ac. tract, John King Sur. ..... T. D. 2,020 ft.; drlg. in chalk.

HAYS COUNTY

Hailey & Whittington's No. 1 Heidenrich, 4,900 ft. from NW line, 400 ft. from NE line of farm, Hemphill Sur. ..... T. D. 735 ft.; shut down; laying water line and will deepen to Trinity.
San Marcos Oil & Gas Co.'s No. 1 A. H. Alford ..... T. D. 513 ft.; waiting on cement.

JIM HOGG COUNTY

Cole Petroleum Co.'s No. 1 Allen, 150 ft. from W line, 336 ft. from N line, Blk. 7, Sur. No. 23 ..... T. D. 800 ft.; drlg.
Wm. H. Barnhart's No. 1 McCampbell, 450 ft. to W line, 150 ft. to N line, Lot 33, Barnhart Subd., Los Viboritas grant ..... T. D. 2,005 ft.; standing.
E. E. Watts' No. 1 Gomez, 4,200 ft. to N line, 1,400 ft. to E line of Sur. 125 ..... T. D. 1,568 ft.; drlg.
J. D. Pulliam's No. 1 Jones, 1,020 ft. W line, 1,020 ft. S line, Share 5-A Hinojosa Sur. ..... T. D. 1,602 ft.; standing.
P. H. Wilson's No. 1 Edds, Sur. No. 210 ..... Rigging up.

JIM WELLS COUNTY

J. Walsh et al's No. 1 W. D. Wade, 1,035 ft. NE line, 300 ft. NW line of N cor., Lot 1, Blk. C, W. H. Bode Sur. ..... T. D. 2,620 ft.; standing.
Prairie Lea Prod. Co.'s No. 1 Oppenheimer ..... Rigging up rotary.

KARNES COUNTY

J. F. Morrissey et al's No. 1 Rigsdale, 660 ft. SW of C of NE line of 170-ac. farm in the McCoull Sur. ..... T. D. 2,000 ft.; standing.
Hurlbut et al's No. 1 Newberry, 450 ft. SE and SW line of Newberry 428-ac. tract, Carlos Martinez Sur. .... T. D. 2,975 ft.; pulling screen.

KENDALL COUNTY

Borgett et al's No. 1 Haag, W. Avery Sur. ..... T. D. 1,110 ft.; drlg. depth corrected.
Sitten et al's No. 1 Garvin, C of NE of D. L. Richardson Sur. in the D. L. Richardson Sur., 1 mile NE from Kendalia ..... T. D. 900 ft.; drlg.
Dickinson et al's No. 1 Edmonson, 150 ft. from S line, 350 ft. from W line of tract in the J. O. Blair No. 72 Sur., 1 mile NW from Kendalia ..... T. D. 40 ft.; dropped from reports until work is resumed.
Dixon Oil Co.'s No. 1 Ottmer Behr, W of H.T.&B.R.R. Sur., 3½ miles SE from Sisterdale ..... T. D. 2,365 ft.; resumed drlg.
P. B. Sterling's No. 1 R. J. McCrocklin, 1,350 ft. from N line, 250 ft. from W line of the B. G. Owens Sur., 4 miles W from Kendalia ..... T. D. 1,405 ft.; shut down; hole full of sulphur water.
R. M. Perkins' No. 1 J. Lawhorn, Sec. 10, 2,475 ft. E line, 1,488 ft. S line ..... T. D. 705 ft.; fishing.
Permian Oil Co.'s No. 1 Boles, S.A.&M.G. Ry. Sur. No. 542½ ..... T. D. 1,050 ft.; drlg.; depth corrected.
Hardy Sitton's No. 1 McMillan, south central part of 180-ac. lease, B. Williams Sur. ..... Location.
Abercrombie Oil Co. and Harrison Oil Co.'s No. 1 Kunz, 900 ft. from E line, 1,900 ft. from S line of McCormack Sur. ..... T. D. 1,460 ft.; drlg. in lime.

KERR COUNTY

Evans et al's No. 1 Love Ranch, 100 ft. from S line Sur. 1,597, 1,000 ft. E of W line of J. Martinez No. 1,594 Sur. ..... T. D. 2,563 ft.; cleaning out.

KLEBERG COUNTY

Bowen & Sarles' No. 1 Robert H. Simmons in the A. Houston Sur. No. 611, Sec. 7, King Subd., 150 ft. out of NW cor. of SW ..... T. D. 1,580 ft.; dropped from reports until work is resumed.

KINNEY COUNTY

Magnolia Pet. Co.'s No. 1 Whitehead-Wardlaw, 2,640 ft. W line and S line of Melton Valdes grant ..... T. D. 3,930 ft.; drlg. in black lime.
Mardon Oil Co.'s No. 2 Jim Clamp ..... T. D. 1,389 ft.; standing.

KIMBLE COUNTY

C. L. Bryant et al's No. 1 Lambert, 7,700 ft. N and W lines of F. Lotta Sur. ..... T. D. 850 ft.; drlg.
Kamon et al's No. 1 Hodges ..... Location.

LASALLE COUNTY

Fred W. Vaiz' No. 1 Coleman, 200 ft. from S and E lines of SW Sec. 514, B.S.&F. Sur. ..... T. D. 40 ft.; set casing.

LAVACA COUNTY

Newton Oil Co.'s No. 1 Reeves, cor. of S line of Reeves tract, John Hueser Sur. ..... T. D. 1,200 ft.; drlg.

LIVE OAK COUNTY

Jacob, Buzzini & Pickett, Inc.'s No. 1 C. E. Kay, in the Bridget Fadden Sur., 3 miles E from George West... T. D. 915 ft.; shut down.
Penn Oil Co.'s No. 2 Lyne Bros., 1½ miles SW of No. 1.. Rigging up.
Houston Oil Co.'s No. 1 D. W. Snyder, 630 ft. from S line, 150 ft. from E line of Snyder tract, T. E. Garner Sur. ..... T. D. 3,100 ft.; drlg.
O. Stalley et al's No. 1 Nichols, 2,000 ft. from W line, 500 ft from S line in the Ayers Sur. ..... Location.
Illinois Exploration Synd's No. 1 Reeves-Brown, 1,300 ft. S of Sellers tract, 1,800 ft. E of Ry. ..... Derrick.
Sid Keoughan's No. 1 C. E. Terrell, 6,000 ft. from N line, 1,000 ft. from E line, Dan O'Boyle Sur. ..... T. D. 2,205 ft.; drlg. in shale.
Tul-Tex Oil Co.'s No. 1 L. Jacobs, 4 miles from N of Callihan Field ..... T. D. 305 ft.; set 10-in. csg.

LEE COUNTY

Burt et al's (M. D. Rickett) No. 1 R. C. Sanders ..... T. D. 3,124 ft.; shut down.
J. P. Perry et al's No. 1 W. H. Thomas ..... T. D. 1,285 ft.; abnd.; hole junked.

McMULLEN COUNTY

Mogul Pet. Co.'s No. 1 Martin, 150 ft. NW line. 150 ft. to SW line of E. Melon No. 212 Sur. ..... T. D. 632 ft.; drlg.
Sheree, Brodie and Emick's No. 1 Shiner, Henry Brewer Sur. ..... T. D. 100 ft.; drlg.

MAVERICK COUNTY

Rycade Oil Corp.'s No. 6 Chittim, 1,445 ft. from S, 320 ft. from W of Sec. 7, I.&G.N. Sur. ..... T. D. 3,525 ft.; shut down.
Rycade Oil Corp.'s No. 5 Sullivan, in C of Sec. 82, Blk. 7, in the I.&G.N. Sur. ..... T. D. 7,092 ft.; trying to sidetrack junk.

MEDINA COUNTY

National Oil Co.'s No. 1 Howard, 1,750 ft. E of W line, 1,854 ft. N of S line of survey in the John George Sur. No. 9, 10 miles S of Dunlay ..... T. D. 1,657 ft.; standing; depth corrected.
Caldwell et al's No. 1 L. W. Burrell ..... T. D. 518 ft.; depth corrected.
Pat Armstrong's No. 1 Crawford, 1,389 ft. N line, 2,550 ft. E line of survey, 487.6 miles W of Devine ..... T. D. 2,710 ft.; drlg.
United North & South Dev. Co.'s No. 1 Little, S from D'Hanis and near S line of county ..... T. D. 3,835 ft.; drlg. in Edwards.

MILAM COUNTY

Rheubotham & Tate's No. 1 Johnson, 325 ft. from N line, 250 ft. from W line of 40-ac. tract, D. Robinson Sur. ..... T. D. 1,475 ft.; drlg.
Kyser, Roberts & Dibble's No. 2 Ward ..... T. D. 1,600 ft.; shot with 20 qts. nitro to clear out junk.
Lloyd Oil Corp. and H. W. Elliott's No. 1 Davis ..... T. D. 1,300 ft.; drlg.
G. I. Moore's No. 1 Davis ..... T. D. 735 ft.; set 8-in. csg.
Peggie Bros.' No. 1 M. Reed ..... T. D. 40 ft.; shut down.
Service Oil & Gas Co.'s No. 1 H. G. Hensley, 500 ft. from NW line, 400 ft. from NE line of 50-ac. tract, Valdez Sur. ..... T. D. 2,180 ft.; drlg.
Service Oil and Gas Co.'s No. 1 R. White, 650 ft. from NE line, 900 ft. from NW line of White tract, Levi Taylor Sur. ..... T. D. 840 ft.; drlg.

NUECES COUNTY

Houston Oil Co.'s No. 1 Comstock, 105 ft. N of C of tract.. T. D. 3,103 ft.; drlg. hard shale
Houston Oil Co.'s No. 1 Joe Hunter, 607 ft. from W line, 165 ft. from S line, 75-ac. tract, Sec. 591 ..... Location.
Bowen et al's No. 1 Theo Prieur ..... Derrick.
Pearson Properties, Inc.'s No. 1 State National Bank ... T. D. 3,640 ft.; coring sandy shale.
Calallen Oil & Gas Co.'s No. 2 Allen, 800 ft. from E line, 1,100 ft. from S line, Blk. 76, Garias Sur. ..... T. D. 1,280 ft.; coring sand; depth corrected.
H. H. Weinert's No. 1 Mohle, 450 ft. from S line, 450 ft. from W line, Sec. 94, Bishop Subd., Palo Alto lands ..... T. D. 452 ft.; set casing.

REAL COUNTY

McGinley Corp.'s No. 1 Haby, C of SW Sec. 175 ..... T. D. 640 ft.; drlg.

SAN PATRICIO COUNTY

J. L. Kennedy's No. 1 McRae, 1,170 ft. NW of the C of the SE line of 500-ac. tract ..... T. D. 2,152 ft.; shut down.
George B. Pickett's No. 1 Baldwin, 900 varas due E of Denton, 1,200 ft. S of the SE cor. of O'Neil Sur., Abstract 211 ..... T. D. 4,020 ft.; shut down.
Saxet Oil Co.'s No. 1 Carroll, 800 ft. N line, 130 ft. to W line, Lot 32-A, Sec. 32 of the fourth subd., Taft farms ..... Temp. abnd.
Cosden Oil Co.'s No. 1 Ramsey, 3,000 ft. from N line, 4,500 ft. from E line, Portilo Sur. ..... T. D. 809 ft.; set 10-in. csg.
Union Prod. Co.'s No. 4 Welder, 2,000 ft. N line, 4,500 ft. E line of tract in the E. Portillo Sur. ..... T. D. 5,893 ft.; cored shale.
G. B. Peterman et al's No. 1 Crow, 150 ft. from S line, 170 ft. from W line of Sec. 24 of the Fulton-Coleman Pasture Lands, J. H. Paul Subd. ..... T. D. 4,096 ft.; shut down.
G. B. Peterman et al's No. 1 Foster, 150 ft. from E line, 1,420 ft. from N line of Blk. 5 of the Welder-Coleman-Fulton Subd., 3¾ miles W from Sinton ..... Location.
LaFeria Oil & Gas Co.'s No. 1 C. C. Smith, in J. C. White Sur., 690 ft. to N line, 350 ft. to E line ..... T. D. 4,067 ft.; shut down.
Cosden Oil Co.'s No. 1 Powell, 330 ft. E line of 36-ac. tract in Sec. 32, Paul Subd., Coleman-Fulton Pasture Lands ..... T. D. 4,127 ft.; drlg.

STARR COUNTY

J. L. Smith's No. 1 Welch, Perdernal Sur. .. .. T. D. 1,060 ft.; drlg.
Virginia Oil Co.'s No. 1 Kelsey-Bass, 150 ft. to S line 1,850 ft. to W line, Blk. 6, Por. 75. Coursao ..... T. D. 375 ft.; set csg.

TRAVIS COUNTY

Fort Bend Oil Co.'s No. 1 Engleman, 450 ft. N line, 150 ft. W line of 108-ac. tract, J. H. Denson Sur. .... T. D. 385 ft.; shut down; depth corrected.
Allen et al's No. 1 Sophie Smith ..... Building derrick.

UVALDE COUNTY

Phantom Oil Co.'s No. 1 Claudt, Sec. 611 ..... T. D. 2,710 ft.; shut down.
Waldrop & Welch's No. 1 E. R. Edmonds, 1,750 ft. NW, 7,200 ft. W of Sec. 71, in the A. Gomez Sur., 8 miles S of Uvalde ..... T. D. 1,610 ft.; shut down.

VICTORIA COUNTY

The Texas Co.'s No. 1 A. M. McFadden, 1,550 ft. N and E lines of H. Bonny Sur. ..... T. D. 5,764 ft.; drlg.

WILSON COUNTY

Rycade Oil Corporation and Getty Petroleum Co.'s No. 1 J. A. Johnson, 150 ft. from N line, 600 ft. E of railroad tract, Jose de Balmaseda Sur. ..... Rigging up.

ZAPATA COUNTY

T. H. Ward's No. 1 Uribe, 150 ft. NW line, 150 ft. SW line, Blk. 8 Subd., Share 7, Partition No. 6, T. Uribe Partition of Jose V. Borrego Sur. ..... Rigging up.
John Poppas Pool, Inc.'s No. 1 Flores, 2,977 ft. SE line, 6,000 ft. Rio Grande River, Porcion 35 ..... Rigged up.
B. F. Nixon's No. 1 A. Guiterrez, 170 ft. S line, 332 ft. E line, Lot 5, Blk. 8, Partition 10, Borrego grant .... T. D. 50 ft.; standing.

DATE OF DERRICK SPECIFICATIONS JANUARY 1929
EMSCO SERIAL NO 18B-GA 48 SIZE 18-B WEIGHT 34059 LBS
HEIGHT 136 FT BASE SQUARE 26 FT 0 IN TOP OPENING 5 FT 8 IN
API DEAD LOAD CAPACITY WITHOUT LEG REINFORCING 397932 LBS
API DEAD LOAD CAPACITY WITH LEG REINFORCING 660372 LBS
LEG REINFORCING SIZE 5 15 LB PIPE
API WIND LOAD CAPACITY 70 MILES PER HOUR
API GIN POLE CAPACITY 10000 LBS
EMSCO DERRICK & EQUIPMENT COMPANY
HOUSTON, TEXAS LOS ANGELES, CAL DALLAS, TEXAS
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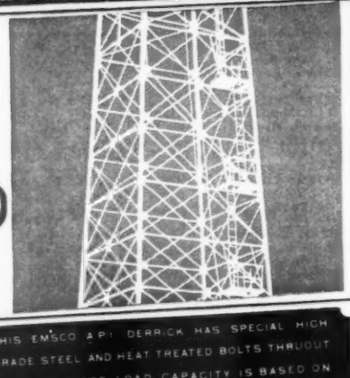

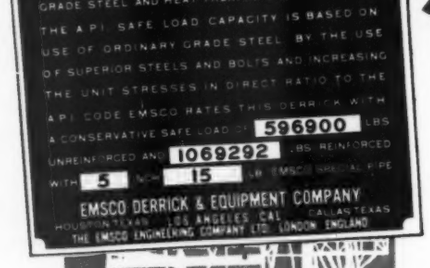
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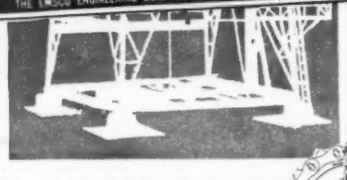

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Penny Prod. Co.'s No. 1 Juan V. Cuellar, Jr., et al, 175 ft. NE line, 175 ft. SE line Poppas Subd., Porcion 33 and 34, Blk. 1, Sur. 2 ..... T. D. 1,725 ft.; drlg.
National Oil Co.'s No. 1-A Adams, 150 ft. N of No. 1, Blk. 4, Sec. 11, Adams Subd., Borrego grant ..... T. D. 1,430 ft.; drlg.
National Oil Co. of Delaware's No. 1 Luther, 617 ft. NW line, 96 ft. NE line, Blk. 97, Da Prom Subd., Porcion 6 ..... T. D. 380 ft.; standing.
Mackenzie and Tallmadge's No. 1 Trevino, 400 ft. SE line, 200 ft. NE line, Blk. 6, Sur. No. 4, Porcion 2 and 3 ..... T. D. 110 ft.; drlg.
F. M. Blair & Son's No. 1 Guiterrez, 150 ft. from NW line, 660 ft. from SW line, Blk. 3, Blair Subd., Comitas grant ..... T. D. 1,750 ft.; drlg.
Lincoln Oil & Gas Co.'s No. 1 Guiterrez, Blk. 23, Subd., La Huerta grant ..... T. D. 1,150 ft.; standing.
J. J. O'Hern's No. 1 S. Benavides, 150 ft. from NW line, 150 ft. from NE line, Blk. 10, Fansler Subd., Villa grant ..... Spudded in.

ZAVALA COUNTY

Ed Anglin's No. 5 Pryor ..... T. D. 1,118 ft.; abnd.
Ed Anglin's No. 6 La Pryor ..... Location.
Carl Cromwell's No. 1 Whitecotton, C of NW Sec. 1, A.P.&M. Sur. ..... Location.
Ed Anglin's No. 1 Matthews, 118 varas from S and W lines of Sec. 4, Blk. 3, L&G.N. Sur. ..... T. D. 1,020 ft.; abnd in Serpentine.
Texas Gas Utilities Co.'s No. 3 Pryor, 900 varas W, 1,108 varas S of Anglin's No. 3 Pryor ..... T. D. 1,687 ft.; drlg. in gray lime.
F. W. Weigand's No. 1 Gates, 1,320 ft. from N line, 230 ft. from NE cor., Sur. No. 13 ..... T. D. 3,115 ft.; shut down.

SOUTHWEST TEXAS PROVEN AREAS

(Continued from Page 66)

Magnolia Petroleum Co.'s No. 13 Dix, 300 ft. E of No. 1, 150 ft. from SE line of lease, Robinson Sur. ..... T. D. 2,570 ft.; drlg. in.
Magnolia Petroleum Co.'s No. 14 Dix, 150 ft. from SE line, 600 ft. from SW line, Dix lease, Robinson Sur. ..... T. D. 855 ft.; drlg.
Magnolia Petroleum Co.'s No. 4 Klein, 300 ft. W of No. 1, 150 ft. from NW line of lease, Robinson Sur. ..... T. D. 2,425 ft.; drlg.
Magnolia Petroleum Co.'s No. 4 Annie Knodel, 450 ft. from NW line, 450 ft. from SW line, Robinson Sur. ..... T. D. 2,534 ft.; waiting on cement
Magnolia Petroleum Co.'s No. 6 Rand Miller, 150 ft. from NW line, 450 ft. from SW line, Alexander Sur. ..... T. D. 2,400 ft.; drlg.
Magnolia Petroleum Co.'s No. 5 Rand Miller, 390 ft. from NW line, 780 ft. from SW line of lease, Alexander Sur. ..... T. D. 2,622 ft.; drlg. plugs; standardizing; estimated at 360 bbls.
The Texas Company's No. 6-A Knoblock, 750 ft. from SW line, 600 ft. from SE line of lease, Robinson Sur. ..... Location.
The Texas Company's No. 7-A Knoblock, 1,225 ft. from SW line, 600 ft. from SE line of lease, Robinson Sur. ..... Location.
The Texas Co.'s No. 8-A Knoblock, 1,592 ft. from SW line, 600 ft. from SE line of lease, Robinson Sur. ..... Location.
The Texas Company's No. 9-A Knoblock, 450 ft. from NE line, 600 ft. from SE line of lease, Robinson Sur. ..... Location.
The Texas Company's No. 4 Pauline Roamel, 850 ft. from SE line, 450 ft. from SW line of lease, Hodges Sur. ..... Location.
The Texas Company's No. 1 Appling, 180 ft. from S line, 450 ft. E of NE cor. of Alexander Sur. in the Hodges Sur. ..... Location.
The Texas Company's No. 7 Posey, 300 ft. SW of NE F. L. Thomson's No. 2 Posey, 25 ft. from NW line, 300 ft. from No. 1 ..... Location.

CHAPMAN POOL—WILLIAMSON COUNTY

W. D. Anderson's No. 6-A T. P. Simmons ..... T. D. 1,745 ft.; completing.
W. D. Anderson's No. 7 M. V. Lawrence ..... T. D. 2,242 ft.; completed for 400 bbls.
W. D. Anderson's No. 8 M. V. Lawrence ..... Location.
Bartlett & Wilson's No. 2 R. E. Stewart ..... T. D. 790 ft.; drlg.
Bartlett & Wilson's No. 1 R. E. Stewart ..... T. D. 741 ft.; drlg.
Chapman et al's No. D-3 J. C. Abbott ..... T. D. 1,820 ft.; completed for 200 bbls. on pump.
Chapman et al's No. D-4 J. C. Abbott ..... T. D. 1,892 ft.; completed for 400 bbls.
Chapman et al's No. D-7 J. C. Abbott ..... T. D. 200 ft.; drlg.
E. L. Chapman et al's No. D-9 J. C. Abbott ..... T. D. 1,900 ft.; completed for 200 bbls. on pump; number changed from 9 to 3.
J. L. Collins & Co.'s No. 7 M. V. Lawrence, 150 ft. from E line, 215 ft. from S line of 27-ac. tract in the S. Miller Sur. ..... Csg. setting; shut down for water.
E. E. Ertell's No. 7 J. C. Abbott ..... T. D. 700 ft.; drlg.
Horn & Stratton's No. 9 J. C. Abbott, W side of lease, 150 ft. from S line in the S. Miller Sur. ..... T. D. 350 ft.; set 10-in. csg.
Marts et al's No. 5 T. P. Simmons, 300 ft. from No. 2, 150 ft. from S line in the S. Miller Sur. ..... T. D. 1,902 ft.; swabbing.
Patton Prod. Co.'s No. 2 J. C. Abbott, on S 32 acres of 96-ac. tract ..... T. D. 1,878 ft.; completed for 150 bbls.
E. L. Chapman et al's No. 2-A Sides ..... Rigging up.
J. L. Collins & Co.'s No. 5 M. V. Lawrence, 150 ft. from W line, 515 ft. from S line of 27-ac. tract, S. Miller Sur. ..... T. D. 1,462 ft.; drlg.
McNeal et al's No. 7 Kilgore ..... Skidding derrick.
E. C. Mead's No. 1 Abbott, 100 ft. from N and W lines of 6-ac. tract, S. Miller Sur. ..... T. D. 2,166 ft.; shut down.
G. Stratton's No. 5 J. C. Abbott, 450 ft. from E line, 150 ft. from S line of 32-ac. tract, S. Miller Sur. ..... T. D. 1,730 ft.; set csg.

PETTUS AREA—BEE COUNTY

Batex Petroleum Co.'s No. 3 Burnett, 360 ft. from N line, 600 ft. from E line of 320-ac. tract, Kerr Sur. ..... Location.
Batex Oil Co.'s No. 2 Burnett, 361 ft. N line, 900 ft. from E line of lease in the south John Pace Sur. ..... T. D. 3,708 ft.; plugged back; estimated 5,000,000 ft. wet gas.
Houston Oil Co.'s No. 1, Block 21, Pettus Townsite, center of block ..... T. D. 4,171 ft.; abnd.; dry.
Humble Oil & Refining Co.'s No. 8 McKinney, S offset to Blk. 21, Pettus Kerr Sur. ..... T. D. 4,300 ft.; dry and abnd.
J. L. Mauldin's No. 1 fee, 1,300 ft. N of S line, 150 ft. E of Medio Creek, Kerr Sur. ..... T. D. 3,734 ft.; shut down for fuel.
Moody-Seagraves Producing Co.'s No. 2 McKinney, 3-340 ft. from E line, 450 ft. from S line, McKinney tract, R. C. Ballard Sur. ..... Location.
The Texas Company's No. 2 J. R. Scott, 200 ft. from N line, 150 ft. from W line, J. M. Urango Sur. ..... T. D. 690 ft.; drlg.
The Texas Co.'s No. 3 J. R. Scott, 7,100 ft. from No. 1, SW ..... Location.
Union Producing Co.'s No. 23 Ray, east offset to Blk. 39 of Pettus Townsite ..... T. D. 3,932 ft.; completed; gauged 52 bbls. per hr.
Union Producing Co.'s No. 25 Ray, 1,700 ft. from S line, 1,400 ft. from E line of P. Miller Sur. ..... T. D. 2,558 ft.; drlg. stick shale and lime.
Union Producing Co.'s No. 26 Ray, 3,500 ft. from S line, 2,000 ft. from E line, P. Miller Sur. ..... Location.

AGUA DULCE FIELD—NUECES COUNTY

South Texas Production Co.'s No. 2 Ollie Purl, 1,200 ft. NE of No. 1 ..... T. D. 1,986 ft.; completed; estimated 35,000,000 ft. gas.
South Texas Production Co.'s No. 3 Walter, 800 ft. from S line, 460 ft. from E line of Walters tract in Section 34 ..... T. D. 1,984 ft.; setting csg. to test gas with 650 lbs. pressure; coring.

SAXET FIELD—NUECES COUNTY

Saxet Oil & Gas Co.'s No. 2 Donnegan, 2,150 ft. due S of No. 1 Donnegan ..... T. D. 5,800 ft.; drlg.
Saxet Oil & Gas Co.'s No. 7 Dunn, 2,400 ft. NW and 200 ft. NE of S cor. of Dunn farm ..... Derrick.
Moody-Seagraves Producing Co.'s No. 1 Smith, 450 ft. from N and E line of 120-acre tract, J. Dunn Sur. ..... T. D. 480 ft.; set 12½-in. csg.

WHITE POINT FIELD—SAN PATRICIO COUNTY

Saxet Oil & Gas Co.'s No. 17 Rachel, 150 ft. from N line, 1,600 ft. from E line of 200-ac. tract ..... T. D. 4,896 ft.

LION McFADDEN POOL—VICTORIA COUNTY

Houston Oil Co.'s No. 1 McFadden, 330 ft. S and 900 ft. E of SE cor. of survey, L. Mann Sur. ..... T. D. 4,633 ft.; abnd.
Lion Oil Refining Co.'s No. 2 McFadden, 1,917 ft. W of NE cor. and 512 ft. at right angles from N line of Edwards Sur., 660 ft. E of No. 1 in the M. J. Travesia Sur. ..... T. D. 6,425 ft.; drill stem stuck; lubricating with oil

LAREDO DISTRICT

SCHOOLFIELD-O'BYRNE POOL—DUVAL COUNTY

Magnolia Petroleum Co.'s No. 1 Edge-Hahl, 150 ft. from N line, 150 ft. from W line, Sur. ..... T. D. 3,837 ft.; drlg.
F. M. Frasher and R. F. Schoolfield's No. 1 Duval Land Co., 990 ft. from N line, 1,320 ft. from W line, Sur. 123 ..... T. D. 1,850 ft.; drlg. sand 1,590-1,600 ft.; tested salt water.

RANDADO POOL—JIM HOGG COUNTY

J. W. Pippin's No. 1 Hinnant, 150 ft. each way from SW cor., Blk. 11, Sur. 147 ..... Derrick.

KOHLER POOL—DUVAL COUNTY

Co-operative Drilling Co.'s No. 4 John Dinn, 450 ft. from N. line, 450 ft. from W line, Blk. 4, Sur. 454 ..... T. D. 1,200 ft.; drlg.
Humble Oil & Refining Co.'s No. 50 Kohler, 2,805 ft. from S line, 165 ft. from W line of Sur. 164 ..... Standing; ready to spud.

S. R. C. POOL—DUVAL COUNTY

S. R. C. Oil Co.-Vacuum Oil Co.'s No. 2 Duval County Ranch Co., 1,050 ft. from E line, 2,050 ft. from N line, Sur. 293 ..... T. D. 1,906 ft.; abnd.; drill stem stuck.

COLE POOL—DUVAL COUNTY

Magnolia Petroleum Co.'s (O'Hern & Seacord) No. 3-A Benavides, 330 ft. from SW line, 330 ft. from SE line, Blk. 12, Sur. 174 ..... T. D. 2,848 ft.; sand 2,841-48 ft.; drlg. plug.

ROMA POOL—STARR COUNTY

The Texas Company's No. 5-A V. C. de Guerra, 675 ft. from N line, 675 ft. from E line, Share 305, Por. 67, Jurisdiction of Mier ..... T. D. 3,670 ft.; sand 3,541-3,670 ft.; tested 7 joints oil and mud, considerable gas; setting csg.

MID-OJUELOS—WEBB COUNTY

O. W. Killam's No. 1 Garcia, 1,050 ft. from W line, 150 ft. from N line, Blk. 45, Ojuelos grant ..... T. D. 1,885 ft.; drlg.

REISER POOL—WEBB COUNTY

O. W. Killam's No. 1 Killam (Villegas) on Blk. 4, Sur. 1,879 ..... T. D. 2,810 ft.; drlg.

CAROLINA-TEXAS POOL—WEBB COUNTY

George S. Marshall's No. 1 C. W. Webster, 810 ft. from S line, 150 ft. from W line, Sur. 684 ..... T. D. 2,110 ft.; drlg.

COLE FIELD—WEBB COUNTY

Alamo Drilling & Leasing Co.'s No. 2 Benavides, 660 ft. from N line, 660 ft. from E line, Blk. 16, Sur. 694 ..... T. D. 2,300 ft.; coring.
O. W. Killam's No. 1 Bruni, 200 ft. from NW line, 450 ft. from NE line, Sur. 10 ..... T. D. 3,022 ft.; testing sand 3,012-22 ft.

CHARCO REDONDO POOL—ZAPATA COUNTY

C. R. Moore and J. W. Moore's No. 1 Adela G. de Flores, 330 ft. from NW line, 330 ft. from NE line, Doty Subd. ..... T. D. 2,000 ft.; standing; sand 1,570-73 ft.; tested dry.
C. R. Moore and J. W. Moore's No. 2 Adela G. de Flores, 150 ft. from NE line, 150 ft. from SE line, Doty Subd. ..... T. D. 150 ft.; drlg.

JENNINGS-MARTINEZ-ZAPATA

South Texas Production Co.'s No. 1 Gutierrez, 2,000 ft. from E line, 660 ft. from NW line of Survey 162 ..... Rigging up.

JENNINGS-MUCKLEROY POOL—ZAPATA COUNTY

Allied Oil & Gas Co.'s No. 12 Guiterrez, 750 ft. from NE line, 3,663 ft. from SE line, Share 4, Fansler Partition, Comitas grant ..... T. D. 1,000 ft.; standing.
Nordan and Morris and Grimm and Yakey's No. 1 S Bustamente, 990 ft. from NE line, 150 ft. from NW line, Share 34, Fansler Partition, Comitas grant ..... Derrick.
Pal-Mar Oil Co.'s No. 1 Jose Bustamente, 150 ft. from NW line, 150 ft. from SW line, Share 35, Fansler Partition, Comitas grant ..... Spudded.
W. R. Shankle's No. 6 Guiterrez, 1,800 ft. from NE line, 2,989 ft. from NW line, Share 4, Fansler Partition, Comitas grant ..... Derrick.
W. R. Shankle's No. 7 Guiterrez, 2,100 ft. from NE line, 2,898 ft. from NW line, Share 4, Fansler Partition, Comitas grant ..... Location.
W. R. Shankle's No. 15 Trevino, 150 ft. from S line, 450 ft. from E line, Block 14, Sur. 65 ..... T. D. 1,258 ft.; sand 1,242-58 ft.; comp. 100 bbls.
S. R. C. Oil Co.'s No. 1 Cuellar, 150 ft. S and W lines, Block 16, Sur. 62 ..... Location.
S. R. C. Oil Co.'s No. 1 F. Cuellar, 300 ft. from S line, 300 ft. from W line, Blk. 6, Sur. 285 ..... Location.
S. R. C. Oil Co.'s No. 2 F. Cuellar, 300 ft. from S line, 300 ft. from E line, Blk. 8, Sur. 19 ..... Location.
S. R. C. Oil Co.'s No. 9-A Cuellar, 450 ft. from NW line, 150 ft. from NE line, Blk. 1, Sur. 65 ..... T. D. 1,029 ft.; waiting on cement.
S. R. C. Oil Co.'s No. 10-A Cuellar, 150 ft. from NW line, 150 ft. from SW line, Blk. 10, Sur. 65 ..... Spudded.
S. R. C. Oil Co.'s No. 9-B Cuellar, 660 ft. from SW line, 150 ft. from SE line, Blk. 7, Sur. 65 ..... T. D. 200 ft.; drlg.
S. R. C. Oil Co.'s No. 2-D G. T. Montemayor, 150 ft. W line, 45 ft. S line, Block 8, Sur. 19 ..... Spudded.
S. R. C. Oil Co.'s No. 3-C (12-B) Trevino ..... Location.
S. R. C. Oil Co.'s No. 12-B Cuellar, 985 ft. from SW line, 110 ft. from NW line, Block 12, Sur. 65 ..... T. D. 1,249 ft.; sand 1,222-49 ft.; comp. 50 bbls.
Whicker, Arnold & Ahler's No. 3 Garza, 150 ft. from SW line, 450 ft. from SE line, Blk. 1, Zerro Ranch Subd., Comitas grant ..... Rigging up.
J. W. Winch's No. 1 Bustamente, 450 ft. from NW line, 150 ft. from NW line, Blk. 7, Share 5, Fansler Partition, Comitas grant ..... T. D. 1,251 ft.; sand 1,236-51 ft.; 600 ft. oil; setting liner.

JENNINGS-CUELLAR POOL—ZAPATA COUNTY

O. W. Killam's No. 1 Slator, Blk. 1, Slator Pasture, Borrego grant ..... Spudded.
O. W. Killam's No. 32-B Cuellar, Sur. 277 ..... Derrick.

MIRANDO VALLEY POOL—ZAPATA COUNTY

O. W. Killam's No. 1 Lopez, 181 ft. from W line, 150 ft. from S line, Blk. 16, Sur. 251 ..... T. D. 1,636 ft.; drlg.

MICHIGAN FIELDS

(Continued from Page 74)

J. O. Druryee's No. 1 Johnson I. Bullard, SE SW Section 10-15n-4w, Isabella Township, Isabella County, near Rosebush, was dry and abandoned in the upper Monroe at a total depth of 4,595 feet.

New locations were the Wittmer company's No. 1 McKenzie, NE NE Section 25-15n-4w, Isabella Township, Isabella County; Owosso Properties Co.'s No. 1 Thompson, SE NE Section 14-7n-3e, Caledonia Township, Shiawassee County; and Johnson Oil Refining Co.'s No. 1 Holland, NW SW SW Section 28-1n-13w, Trowbridge Township, Allegan County.

Muskegon Deep Test

The first deep test in the proved Muskegon Field failed to make commercial gas production in the Monroe formation at 2,270 feet, and the Muskegon Gas Co. laid plans to make the change back to artificial gas for domestic consumers within the next 30 days.

The well was drilled into gas pay sands Friday, November 7, but made only about a 200,000-foot flow. A week ago the well struck gas at 2,255-65 feet with pressure and volume enough to lift a column of 2,000 feet of salt water over the top of the 85-foot derrick. It made three flows and was cased and cemented at about 2,250 feet just above the gas sands.

Drilling will be continued with an 8-inch hole in the hopes of striking additional gas or oil in the Monroe. If unsuccessful at this depth work will proceed to the Niagara or lower formations as was originally intended.

SOUTHWEST TEXAS FIELDS

(Continued from Page 66)

a hard time getting casing set due to the heavy gas pressure but finally got it set more than a week ago. The well is in the middle of the field. The same company's No. 1-A Boothe, a replacement to No. 1 which was lost at about 1 mile depth, is now down to 5,263 feet and topped the sand at 4,248 feet. No. 1 at 5,252 feet on drill stem test looked like a big gas well but the hole was lost. It also showed some oil with the gas.

In northwestern Duval County the S. R. C. and Vacuum Oil Co. finally lost No. 2 Duval Land Co. in Survey 293, a few hundred feet southwest of the discovery well which is flowing about 300 bbls. daily. No. 2 failed to find the sand producing at 1,724 feet in No. 1 and at 1,906 feet was lost with drill stem stuck in the hole. Another location will probably be announced soon.

Vacuum Oil Co. is moving in and about ready to start on a test in Survey 280 which is several miles southwest of Survey 293 and the S. R. C. Pool.

Bexar County

In Bexar County Penn Oil Co. is coring all the way in No. 1 Kosub, reported last at a little below 1,000 feet. It has had some favorable showings and is the first test started in eastern Bexar where the company brought in No. 1 Cooksey at 1,460 feet producing on the pump 50 bbls. of oil a day. No. 1 Kosub is after information on the formations and is located a little northeast of the discovery well. Regardless of other sands it will probably go to the Edwards as the company is due to test the Edwards in that territory and on that lease block. Development of the shallower sand at 1,460 feet can be delayed till later.

Frio County

A. H. Wray finally tested out No. 1 Burns in northeastern Frio County about 30 miles southwest of San Antonio and got a small gas well at 2,308 feet, but was not satisfied and is drilling deeper. Late in the week it was below 2,600 feet and drilling. Its next chance is at the contact with the chalk and the next after that in the Edwards which will be down at 3,000 feet or more.

South of Seguin Adams & Lyles' No. 1 Seligman, with elevation of 464 feet, topped the chalk at 1,939 feet and topped the Edwards at 2,251 feet and drilled to 2,270 feet without showing anything even water. It is in that same territory southeast of Seguin that has been wildcatted over so thoroughly and looks like another failure.

In the White Point Field in Nueces County Saxet's No. 17 Rachel, reported last week with an oil showing at 4,896 feet, has set casing at 4,880 feet and same time this week should be ready to make a test. This is one of a series of deep tests the Saxet Oil Co. is making in that region and the first in the White Point Field on the north side of the Nueces Bay. On the south side of the bay in Nueces County the company's first deep test got a small well at around 4,000 feet and the second which is the No. 2 Donigan is down 5,800 feet and drilling.

KANSAS FIELDS

(Continued from Page 61)

1,875 feet on the last report. The owners expect to find the Dakota sand at approximately 2,150 feet. The test is contracted to be drilled to 3,500 feet unless oil and gas is found at a lesser depth. The test is a wildcat and is the most northwesterly drilling test in the State at the present time.

In Edwards County, the Dixie Oil Co. and others' No. 1 McCarty, SW cor. SE, Section 30-25-17w, was shot with 10 quarts at 4,563-68 feet where a showing of oil was found. The test was drilled to a total depth of 4,599 feet. It is believed the shot increased the showing of oil while the crew is cleaning out.

Butler County

National Refining Co.'s No. 1 Settergren, NW cor., Section 32-26-4, is dry and abandoned at 2,898 feet. No. 1 Hedderman, SW cor. NE, Section 24-28-5, an old well drilled deeper, has been abandoned at 3,210 feet.

Cowley County

Roth & Faurot staked location for No. 4 Holt, NW cor. SE, Section 12-32-4. Lewis Production Co. moved a machine in for No. 1-A Roberts, NE cor. SW, Section 12-32-4. Suppes and others' No. 1 Graham, SW cor. NW SE, Section 33-32-7, is a machine. Pyle and others' No. 1 Pudden, C SE NE, Section 16-35-4, is an old well being rigged up to deepen from 1,756 feet.

Elk County

Ferguson and others' No. 1 Ferguson, SW cor. NE SW, Section 23-30-8, an old gas well, has been deepened from 1,798 feet to 2,911 feet, filling up with 1,500 feet of oil in 10 hours and is now shut down for connection.

Ellis County

Deep Rock Oil Corp. made location for No. 1 Perry, NE cor. SE, Section 19-11-17w.

Greenwood County

Simmons and others' No. 5 Harris, SW cor. SE NW, Section 19-22-11, has been completed for 75 bbls. in sand 2,014-45 feet. Shull Drilling Co.'s No. 1 Johnson, NE cor. SE NW, Section 16-24-12, made 100 bbls. from sand 1,562-87 feet.

Lyon County

Sheedy and others' No. 1 Welch, SE cor. NW, Section 31-20-10, is a rig.

Marion County

Harwood Oil Co. has the rig up for No 1 Tolman, SE cor. NW SW, Section 11-17-4.

McPherson County

McPherson Oil & Gas Co. and Shell Petroleum Corp.'s No. 1-B Giffin, C SW NE, Section 14-19-2w, is moving in. No. 1 Meyers, C NE NE, Section 14-19-2w, is also moving in. Reserve Oil & Gas Co. and Shell Petroleum Corp.'s No. 1 Ritz, SE cor. SW, Section 31-19-1w, is moving in material. Lario Oil Co. and Shell Petroleum Corp.'s No. 1 O. A. Ritz, NE cor. SW, Section 1-20-2w, is a slush pond. Helmerick & Payne and others' No. 1 Boesker, NW cor. NE, Section 18-20-1w, is a rig under construction.

Rice County

Stearns & Streeter and others dug the cellar for No. 1 Blake, NE cor. NW, Section 9-18-10w.

Rush County

Boyle, Grosman and others made location for No. 1 Greenwalt, C SW, Section 17-19-16w.

Russell County

Liggett and others' No. 1 Whitson, SW cor. NW SW, Section 16-11-15w, is a rig on the ground.

Sedgwick County

National Refining Co. is building the rig for No. 1 Doctor Gselle, SE cor. SW SE, Section 1-27-1, Eastborough Pool.

Stafford County

Mid-West Exploration Co.'s No. 36 Richardson, SE cor., Section 36-22-12w, has been completed for 340 bbls. in sand 3,541-99 feet, swabbing this amount in six hours. Boucher and others' No. 1 Sinclair, NE cor., Section 9-22-11w, has been abandoned at 3,587 feet.

Stevens County

Missouri-Kansas Pipe Line Co. and others' No. 1 Gregory, C SW, Section 31-33-38w, is rigging up. Missouri-Kansas Pipe Line Co. and others' No. 1 Young ren, NE cor. SE NW, Section 24-32-39w, has been completed for 1,460,000 feet of gas in sand 2,585-2,646 feet. Western Production Co.'s No. 1 W. R. D. Fee, C SE, Section 21-32-38w, made 11,253,000 feet of gas from sand 2,540-2,703 feet. No. 3 W. R. D. Fee, C NE, Section 24-32-38w, has been completed for 14,000,000 feet of gas in sand 2,515-2,782 feet. No. 2 W. R. D. Fee, C NW, Section 26-32-38w, gauged 11,451,000 feet of gas from sand 2,602-2,761 feet. Argus Production Co.'s No. 4 Ratcliff, C SE, Section 26 32-38w, had sand 2,583-2,775 feet and gauged 3,478,000 feet of gas. No. 1 J. A. Porter, C SE, Section 9-32-37w, made 3,861,000 feet of gas from sand 2,576-2,778 feet. No. 3 Ratcliff, C SW, Section 8-33-37w, has been completed for 5,000,000 feet of gas from sand 2,590-2,685 feet. Western Production Co.'s No. 1 John Burrows, C SW, Section 31-34-37w, made 1,133,000 feet of gas from sand 2,685-2,820 feet.

Sumner County

W. K. Mann's No. 2 Herrick, NW cor. SW SW SE, Section 25-31-2, is a machine rigging up.

LA.-ARK. FIELDS

(Continued from Page 64)

and others, SE NE, Section 2-20-4, Morehouse Parish. Greenwood Production No. 5 Norsworthy, Section 9-20-3, Union Parish, made 1,331,000 feet of gas at 990 pounds from 2,200 feet. Southern Carbon Co.'s No. 1 G. Harris, NE NE, Section 10-16-6, Richland Parish, gauged 37,116,000 feet at 645 pounds, total depth 2,457 feet. Island Gas Co. made a fifth test on No. 1 Noe, NE SE, Section 3-16-5, a wildcat 1½ miles west of production, at 2,560-96 feet and got salt water again and shut down at 2,630 feet. T. G. Shaw's No. 1 Wilkinson, Section 4-12-10, a semiwildcat on the edge of production in the old Bull Bayou Field of Red River Parish, has 700 feet of oil in the hole from 2,838 feet, also a fishing job, the bailer getting stuck. A drill stem test at 2,794-2,818 feet on Arkansas-Louisiana Pipe Line Co.'s No. 1 Griffith, NE NW, Section 17-22-10, West Carroll Parish, northeast of the Monroe gas field, was dry.

Lion's Big Purchase

Lion Oil Refining Corp. and the Sun Co. were the principals in the largest trade for Arkansas production that has been made in some time, the former buying all the latter's holdings in Smackover consisting of 420 acres with 700 bbls. daily production. Just what was paid for the properties is only rumor, but whatever the figure was it is understood to have been a part cash-part oil proposition. The property is about equally divided between producing and nonproducing semiwildcat acreage in Section 30-15-15; Sections 1, 5 and 9-16-16; Sections 22 and 27-15-16, and Sections 3, 6 and 19-16-15.

H. R. Smith did not run drill stem test at 2,891-2,903 feet on No. 1 Lytle, Section 31-18-3, Chicot County, as planned, and is drilling at 2,910 feet. In Union County, Lion Oil Refining Co. has rig up for No. 2 Sullivan, NE NW, Section 12-17-14, Champagnolle, and has begun drilling No. 1 on the same lease but in the SE NW, Section 12. Malley & Co.'s No. 7 Burns, NW NW, Section 31-17-5, in the old El Dorado Pool, has 35 feet of fluid in the hole from 2,213 feet and will put the well on the pump.

Oil Field Corp.'s No. 1 Simmons, NW NW, Section 13-18-13, Urbana district, was dry at 2,301 feet, tested three joints of mud and oil at 2,326 feet and is drilling at 2,775 feet. H. L. Hunt's No. 5 Swilly, NE NE, Section 28-16-16, a wildcat about half way between Lisbon and Smackover production, has 2,000 feet of fluid in the hole from 2,689 feet and is awaiting pumping rig; No. 6, SE SE, Section 21-16-16, is a location. A. B. Turner abandoned No. 1 Brown, SE SW, Section 23-15-18, Mount Holly district of Ouachita County, at 2,183 feet as a junked hole, skidded 50 feet and has begun drilling second hole.

East of Texarkana

In the Garland City wildcat play east of Texarkana, E. & F. Oil Co. is coring No. 1 Beck, Section 36-15-26, at 2,910 feet, and C. V. Lenz is coring No. 2 Johnson, Section 24-15-26, a north offset to the discovery well, at 3,100 feet. The latter was completed at 2,849 feet. No. 2 Johnson got oil and salt water on drill stem test at 2,920 feet and the E. & F. well had 125 bbls. of salt water and about 15 bbls. of oil on a test at 3,814 feet. East Texas Oil & Gas Co.'s No. 1 Harvey, Section 2-15-26, is shut down for orders at 900 feet after a dry test at 888-90 feet. E. R. Henderson has made location for No. 1 J. L. Lee, NW cor. SW SE, Section 31-8-23, a mile south and 1½ miles east of No. 1 Tilyou, Section 20-8-24, at Delight, Pike County. The latter, last reported on a month ago, was at that time drilling at 1,270 feet. Modisette Drilling Co. has abandoned location for No. 4 Union Sawmill, Section 14-18-14, which was to have been a deep test in the Urbana district of Union County. Conn Grable's No. 1 Hoeing, Section 20-9-25, Johnson County, was dry and abandoned at 2,238 feet.

John C. Rogers got a 14-inch core of sand showing oil from No. 1 Lanier, K. E. Welborn Survey of Cass County, Texas, at 2,180 feet. Above it was 200 feet of broken sand showing gas and he is arranging to run drill stem test from 1,920 feet where he got the first sand to show gas, to the bottom. The Texas Company is drilling 8 miles north and was in hard sand at 1,953 feet on No. 1 Citizens State Bank, Joseph Watkins Survey, checking 26 feet higher than Rogers. W. D. Chew abandoned No. 1 Fee, W. J. Hamilton Survey in Marion County, 7 miles west of Vivian, La. It was dry at 3,328 feet, plugged back to 1,550 feet, and was dry again. P. E. Hussey's No. 1 Trammell in the Charles Lockhart Survey of Marion County is reported to have had a good show of oil in a core cut in lime at 1,884 feet. The Texas Company's No. 2 Brumble, E. F. Mitcheson Survey of Panola County, made 760,000 feet of gas at 910 pounds from 2,350 feet, and Natural Gas Producing Co. completed No. 8 Roquemore in the B. C. Jordan Survey making 25,000,000 feet of gas as another well in the deep Trinity, total depth 4,707 feet.

OKLAHOMA FIELDS

(Continued from Page 60)

the deep sand in Section 30-8-8, and the Mid-Kansas Oil & Gas Co. has taken over the operation of these tests. The discovery well in the area drilled by the Deep Rock Oil & Refining Co., the No. 1 Whitworth, in Section 30-8-8, is making around 2,400 bbls. a day on the air-gas lift.

New locations are being staked on the Wewoka townsite, making it the only townlot area outside of Oklahoma City Pool in the State. The Hamilton Development Co. has announced a location on Block B in approximately the SW cor. SE Section 30-8-8.

4,000-Bbl. Well in Carr City

The Carr City extension area is the most active drilling area in the Seminole district. New producers are expected to be completed during the week. Gypsy Oil Co.'s No. 1 Tiger, SE cor. SW NW Section 3-8-5, is estimated to be a 4,000-bbl. well from the Viola and Hunton lime at a total depth of 4,089 feet. Pure Oil Co.'s No. 1 Tiger, SW cor. NE SW Section

3-8-5, swabbed 80 bbls. in one and one-half hours from the Wilcox sand at 4,142-60 feet. After swabbing, the hole filled up 1,700 feet with oil. It will be given a shot. Empire Oil & Refining Co.'s No. 2 Larney, NE cor. SE Section 3-8-5, is shut down for a pipe line connection in Wilcox sand at a total depth of 4,146 feet.

Another test is expected to reach the pay horizon in the new area southeast of East Earlsboro Pool, when The Texas Company and others' No. 1 Knight, NE cor. NW SW Section 29-9-6, Seminole County, found a showing of gas in the Simpson sand at 4,080 feet. The log of the test shows the Viola lime to be about 38 feet, which is 10 feet less than the discovery well of the Amerada Petroleum Corp. and Dixie Oil Co. The owners believe the test has the formations regular. The Wilcox sand was found at 4,110-39 feet, where oil rose 3,000 feet in the hole and the operators were preparing to swab.

Big Gasser in Perry Area

One completion was reported in the Perry Pool, in Noble County, during the week and one location was staked in the Otoe Indian Reservation district. Twin State Oil Co.'s No. 1 Trussell, NE cor. SE, Section 6-20-1w, was shut in with 14,000,000 feet of gas a day. It was showing a small amount of oil when shut in. Washoma Petroleum Co. and others' No. 1 Otoe, NE cor., Section 22-22-1, is a location, and is expected to be started the next 10 days. Prairie Oil & Gas Co.'s No. 1 Upperman, SW cor., Section 22-22-1, is spudding.

Magnolia Petroleum Co.'s No. 2 Weeder, NE cor. NW NW, Section 22-21-2w, Noble County, is being drilled into the Wilcox sand at 5,921 feet with nothing showing. Same operator's No. 1 Wollossen, SE cor. NE NE, Section 21-21-2w, is recementing surface pipe while the total depth of the test is 4,750 feet.

In the Reiter-Foster Pool in Payne County, Reiter-Foster Oil Corp.'s No. 1 R. Finnell, has been plugged back from a total depth of 5,100 feet to 4,989 feet where it may be shot. A showing of oil was found in the test. Production reports from the producing wells in the area were as follows: Reiter-Foster Oil Corp. and others' No. 1 T. Finnell, C NE NW, Section 5-19-1w, was flowing 242 bbls. a day under proration and the same operators' No. 1 P. Watkins, C SW SE, Section 5-19-1w, was flowing 103 bbls. with the production curtailed.

The Prairie Oil & Gas Co and others' No. 1 Parkinson, SW cor. NW, Section 22-7-2w, a wildcat near Purcell in McClain County, was drilling at 5,614 feet. Producers & Refiners Corp. has secured leases on several tracts in Section 27-5-4w, McClain County. Minnehoma Oil Co. has leased the E half SE SW and SW SE SW, Section 34-5-3w, McClain County.

New Hunton Lime Area

The possibilities of a new Hunton lime producing area northeast of the old Cromwell Pool, in Okfuskee County, were bright when the Carter Oil Co. and others' No. 1 Miller, SW cor. NE SW, Section 11-11-8, filled up 2,500 feet with oil in a short time. The Hunton was found at 3,950 feet, and the oil showing was found at 4,000 feet. The semiwildcat test missed the Cromwell sand, which is the main producing horizon in the area, causing the operators to drill deeper, and test the Wilcox sand. It was drilling deeper at 4,025 feet.

Other tests in the vicinity were nearing the pay horizons. Tulsa Oil Co.'s No. 1 David, SE cor. NW, Section 3-12-9, Okfuskee County, had the Dutcher sand at 3,295-3,312 feet with a showing of oil and was drilling deeper at 3,400 feet.

Greater Seminole Production

The production from the Greater Seminole area for the week ending November 3 was as follows:

Pool—	Wells	Bbls.
Little River	370	22,764
East Little River	85	12,101
Carr City	70	9,307
Maud	135	3,041
Mission	92	5,424
Bowlegs	278	13,389
Earlsboro	283	14,953
South Earlsboro	27	8,657
East Earlsboro	158	14,475
Seminole	259	13,402
East Seminole	33	2,091
Searight	86	6,860
Allen	273	14,126
Asher	26	1,007
West Asher	43	10,523
Konawa	102	16,520
Sasakwa	51	4,897
St. Louis	482	22,219
Total	2,852	195,747

Greater Seminole Shipments

The pipe line shipments from the Greater Seminole area total 175,718 bbls. for the week ending November 3. The daily averages from the various pools were as follows:

Company—	Semi-nole bbls.	Asher-Pearson, St. Louis bbls.	Konawa bbls.
Barnsdall	1,998	.....	.....
Champlin	4,670	.....	522
Consolidated	....	3,323	.....
Cosden	7,335	.....	5,259
Deep Rock	2,072	582	.....
Empire	3,685	.....	.....
Gulf	13,089	2,977	133
Magnolia	4,885	5,519	.....
Oklahoma	20,653	140	235
Prairie	13,258	4,558	3,693
Prod. & Refrs.	388	.....	.....
Pure	3,900	.....	.....
Shell	1,796	573	1,466
Stanolind	26,508	6,872	3,545
Texas	8,289	5,247	2,361
Tidal	9,033	3,957	.....
Total	121,538	33,748	17,214
Tank cars	1,368	1,850	
Grand total	122,906	35,598	

Oklahoma City Oil Shipments

The total shipments from the Oklahoma City Pool for the week ending November 3 were 584,668 bbls. The daily average shipments by companies were as follows:

Company—	Dy. av. (bbls.)
Empire	17,443
I.T.I.O.	3,907
Magnolia	9,752
Oklahoma	11,008
Prairie	14,589
Stanolind	21,759
Shell	260
Tidal	2,509
Gulf States	1,675
Century	443
Anderson-Prichard	180
Total	83,524

Oklahoma City Production

The following wells were on production in the Oklahoma City Pool during the seven days ending November 3, under the proration orders. All other completed wells were shut in and will be produced when the shut-in time is completed.

	S.T.R.	Well No.	Bbls.
Anderson-Prichard:			
Gibbons	1-11-3w	4	76
Graham	2-11-3	1	8
Habegger	14-11-3	1	179
Key	2-11-3	1	144
Moore	2-11-3	1	111
Roosevelt Place	2-11-3	5	342
Coline:			
Clour	25-11-3	16	18
Warren	18-11-2	8	363
Continental:			
Sudik	6-10-2	3	488
Cromwell-Franklin:			
T. Park	13-11-3	30	10,269
Hall Briscoe:			
Holmes	10-11-3	4	3,314
Lindsey	14-11-3	3	1,475
Muller	2-11-3	1	235
Heeman-Coe:			
Cunningham	1-11-3	2	372
I. T. I. O.:			
Banta	18-11-2	1	12
Barker, Drake	14-11-3	1	1,352
Bod. Anderson	30-11-2	3	21
Bodine, A.	24-11-3	6	116
Bodine, S.	30-11-2	3	22
Butterfield	11-11-3	1	1,003
Button	19-11-2	5	36
Canfield, L.	19-11-2	2	39
Coppinger	11-11-3	8	156
Drake	14-11-3	2	1,001
Emmerson, N.	30-11-2	11	1,351
Farley, Fuzzell	19-11-2	2	227
Ferndale, Comm.	11-11-3	4	1,210
Hammer	11-11-3	2	143
Huffman	14-11-3	2	49
Johnson	25-11-3	9	321
Jones, H. W.	1-11-3	4	361
Jones	31-11-2	14	1,609
Jones, Comm.	1-11-3	4	963
Knox, May	14-11-3	4	790
K. Henning	24-11-3	3	10
Lawrence Place	15-11-3	2	799
Magnolia Heights	14-11-3	1	192
M. K. & T.	35-12-3	4	328
Mt. Vernon Heights	15-11-3	1	118
Okla. City	24-11-3	1	22
Pasadena Heights	14-11-3	3	392
Peterson, Sad	25-11-3	8	420
Phelans	15-11-3	2	21
Phillips	1-11-3	1	349
Procure, A.	11-11-3	1	803
Salasman	32-11-2	5	156
Sudik	31-11-2	11	3,564
Theimer, E.	12-11-3	8	61
Thom. Fuzzell	13-11-3	3	101
Trosper	13-11-3	10	416
Trosper, Clar.	14-11-3	4	496
Trosper, C. E.	11-11-3	1	409
Trosper, E.	14-11-3	2	809
Trosper, H. G.	14-11-3	5	188
Trosper, L.	12-11-3	3	414
Trosper, Hughes	11-11-3	1	296
Unsell, M.	23-11-3	6	695
Unsell-Krager	23-11-3	3	581
Viewpoint	10-11-3	3	537
Warden, M.	24-11-3	1	39
Waters	23-11-3	6	275
Wheeler	13-11-3	3	73
Wilkie-Anderson	25-11-3	3	54
Williams	23-11-3	1	251
Williamson, Can.	24-11-3	2	79
I. T. I. O. et al:			
Boulevard, Add.	14-11-3	1	108
Mid-Kansas:			
Fortson	24-11-3	5	35
Mollman	23-11-3	4	559
Trosper, D. B.	19-12-1	1	173
Mid-Kansas-Ramsey:			
Messer	32-14-3	1	201
Minnehoma:			
Pugh	2-11-3	1	557
Morgan:			
Stout	2-11-3	1	32
Oils, Inc.:			
Ross	2-11-3	1	1,675
Phillips:			
Jones	1-11-3	1	183
Phillips-Sinclair:			
Lybrand	2-11-3	1	994
Prairie-Slick:			
Hiddleston	19-11-2	7	319
Sigmon	32-11-2	7	1,593
Reynolds, W. R.:			
Hastings	1-11-3	1	1,166
Shaffer, J. C.:			
Childs	14-11-3	1	174
Shaffer, J. C., et al:			
Vinita Park	2-11-3	2	1,416
Shell:			
Egermeir	23-11-3	1	181
Petty	30-11-2	7	79
Sinclair:			
School Land No. 55	36-11-3	16	2,445
School Land No. 67	36-11-3	4	1,229
Vencl	31-11-2	16	7,749
Sinclair-Amerada:			
Kinter	30-11-2	10	19
Sinclair:			
School Land No. 69	36-11-3	3	4,181
Skelly:			
Fields	10-11-3	1	652
Skelly et al:			
Hurt	2-11-3	1	683
Hoops	31-11-2	8	1,156
Tanner	10-11-3	2	94
Slick, T. B.:			
Clegg	2-11-3	1	155
Foote	2-11-3	2	354
Frost, C. G.	10-11-3	1	263
Glidden	13-11-3	2	39
Moore	2-11-3	1	168
Trumbley	2-11-3	1	101
Wespaco	34-12-3	1	348
Slick, T. B., et al:			
Alexander	2-11-3	2	191
Lard	2-11-3	1	667
Milner	1-11-3	2	58
Storie	2-11-3	1	1,047
Townsend	1-11-3	2	2
Zerkerle	13-11-3	1	143
Hoops	31-11-2	8	641
Hussman	29-11-2	1	219
Slick-I. T. I. O.:			
Dennis	11-11-3	1	304
Huddleston	14-11-3	1	214
Houston	2-11-3	1	64
Wirt Franklin:			
Eacock	11-11-3	1	415
Lowery	12-11-3	10	4,740
Shahan	2-11-3	1	128
Theimer	2-11-3	12	2,042
Theimer-Butt	11-11-3	1	220
Wright-Smith:			
Smith	2-11-3	2	91
Total		634	81,442
Last week		626	79,774

New wells, 9. Dry and abandoned, 1. Increase, 1,688 bbls. Average per well for pool, 128 bbls.

Beckham County

Producers Exploration Co.'s No. 1 Pederson, NE cor. NW, Section 23-9-23w, Sayre Field, is an old well drilling deeper at 2,927 feet showing oil and gas. Mid-Tex Oil Co.'s No. 1 Seidel, SE cor. SW SW, Section 17-9-22w, is rigging up to deepen from 2,402 feet.

Caddo County

Mid-Kansas Oil & Gas Co. and Ramsey Petroleum Corp.'s No. 1 Rowe, SW cor. NW NE, Section 36-6-10w, is an old well deepened from 3,316 feet to 3,328 feet, flowing 1,196 bbls. Clyde Kahl's No. 1 McKenna, SW cor. NE NW, Section 31-6-9w, has been abandoned at 4,980 feet. English Drilling Co.'s No. 7 Abernathy, SW cor. NE SE, Section 31-6-9w, has been abandoned at 2,312 feet. Badgett & Cooper's No. 1 Miller, NE cor. NW SW, Section 25-4-8w, has been completed for 4,000,000 feet of gas in sand 1,840-50 feet, total depth 1,867 feet.

Grady County

Badgett & Cooper's No. 1 Noah Berry, C N half NW, Section 25-4-8w, is cementing surface pipe. Meridian Gas Co.'s No. 3 Kinnard, CWL SE NE, Section 36-4-8w, has been completed for 8,000,000 feet of gas in sand 2,025-2,125 feet.

Hughes County

Canady and others' No. 1 Kanard, NW cor. SW, Section 29-9-12, is dry and abandoned at 4,505 feet. Mid-Kansas Oil & Gas Co.'s No. 1 Street, SW cor. NW SW, Section 16-7-8, is dry and abandoned at 3,576 feet. Magnolia Petroleum Co.'s No. 2 Jackson, NE cor. SW NE, Section 17-7-8, has been completed for 32,000,000 feet of gas in Booch sand 2,926-46 feet.

Oklahoma County

Phillips Petroleum Co. has the cellar dug for No. 1 Crean, SE cor. NE, Section 3-11-3w, Oklahoma City Pool. Thomas B. Slick estate made location for No. 1 Central, Block 1, Lot 12, Central Addition, SE cor. NE SE, Section 3-11-3w. Phillips Petroleum Co. staked location for No. 1 Henderson, Block 1, Lot 14, Blevins Second Addition, SW cor. NW NW NE, Section 10-11-3w. Location was made for No. 1 Robb, Block 12, Lot 26, Schilling Addition, SE cor. SW NE SW, Section 10-11-3w. Mabee and others is a location, Block 8, Lot 6, Eckroat Addition, SE cor. NE NW, Section 10-11-3w. Hall & Briscoe's No. 1 Mueller, SW cor. SE NW, Section 2-11-3w, has been completed for 15,352 bbls. in 17 hours from sand 6,420-6,545 feet. Minnehoma Oil Co.'s No. 1 Pugh, SW cor. NW, Section 2-11-3w, has been completed in sand 6,242-6,520 feet for 40,344 bbls. in 16 hours. Wirt Franklin Petroleum Corp.'s No. 1 Shahan, SE cor. SW SW, Section 2-11-3w, flowed 1,289 bbls. in eight hours from sand 6,212-6,533 feet. Indian Territory Illuminating Oil Co. and others' No. 3 Ferndale Community, SW cor. NE NE, Section 11-11-3w, topped the Stamper sand at 6,550 feet, drilled to 6,556 feet and plugged back to 6,549 feet where it made 3,120 in eight hours. Coline Oil Co.'s No. 4 Olds, NE cor. NW, Section 24-11-3w, has been completed for 18,000,000 feet of gas at 5,908 feet after being plugged back from 6,547 feet. Sinclair Oil & Gas Co. and Independent Oil & Gas Co.'s No. 2 School Land No. 69, NW cor. NE NE SW, Section 36-11-3w, had sand 6,565 feet, total depth 6,700 feet and flowed 8,688 bbls. in eight hours. No. 3 School Land No. 69, SE cor. NE SW, Section 36-11-3w, has been completed for 5,607 bbls. in eight hours from sand 6,615-6,700 feet.

Osage County

Link Oil Co. moved a machine in for No. 2-A, NW cor. NE NE, Section 33-25-9. Atlantic Oil Producing Co.'s No. 8, CNL S half SW, Section 19-25-8, has been completed for 45 bbls. in chat 2,466-2,500 feet. Western American Oil Co.'s No. 16, NE cor. SW NE SW, Section 4-24-10, is dry and abandoned at 2,154 feet.

Pawnee County

W. A. Rookstool is erecting the rig for No. 1 Berry, NW cor. NE SW, Section 6-20-5. Glass and others' No. 2 P. McCollum, NW cor. SE NW, Section 14-20-9, is drilling at 160 feet. Johnson Oil Refining Co. and others' No. 1 Mills, NE cor. SE NW SE, Section 35-20-9, is dry and abandoned at 2,111 feet in Bartlesville sand.

Pottawatomie County

Gypsy Oil Co.'s No. 2 Horn, NW cor NE, Section 23-6-3, West Asher Pool, made 4,525 bbls. in sand 3,505-26 feet. Indian Territory Illuminating Oil Co.'s No. 6 Davidson, SE cor. NW, Section 23-6-3, has been completed for 770 bbls. in sand 3,471-84 feet.

Seminole County

Pace Petroleum Co. has the cellar dug for No. 1 Wewoka Townsite, Block B, Hamilton Addition, SW cor. SE NE, Section 30-8-8. Gypsy Oil Co. made location for No. 5 Denmark, SE cor. SW SE, Section 11-7-6, Little River Pool. Amerada Petroleum Corp. and Dixie Oil Co.'s No. 1 Morris, SE cor. SW NW, Section 29-9-6, East Earlsboro Pool, has been completed for 2,115 bbls. in Wilcox sand 4,123-49 feet after plugging back from 4,153 feet. Amerada Petroleum Corp.'s No. 1 Tiger, NW cor. NE SW, Section 3-8-5, Carr City Pool, made 2,710 bbls. from Wilcox sand 4,124-40 feet. Deep Rock Oil Corp.'s No. 1 Whitworth, NW cor. SW NE, Section 30-8-8, Wewoka Townsite Pool, has been completed for 2,537 bbls. in Wilcox sand 3,899-3,922 feet. Sinclair Oil & Gas Co.'s No. 1 M. Caesar, NW cor. SE, Section 29-6-6, flowed 735 bbls. from sand 2,737-69 feet.

Neal & Milton's No. 1 Thomas, NW cor. NE SW, Section 9-6-7, is dry and abandoned at 3,035 feet.

Stephens County

Pace and others' No. 1-B H. Green, NW cor. SE NE, Section 2-2s-8w, is drilling at 320 feet. No. 4 Dilley, NW cor. NE NW SW, Section 27-2s-7w, is drilling at 500 feet.

Washita County

Snodgrass and others' No. 1 Blocker, NW cor., Section 29-8-19w, is shut down at 135 feet. Burns & Prince's No. 1 M. Dock, NW cor., Section 21-8-18w, is rigging up.

Carter County

Trevelyn Oil Co. is building the rig for No. 1 S. V. Hooks, NW cor. SW SE, Section 13-1s-3w, Tatum Pool. Anderson and others' rig is up for No. 7 Eaves, SW cor. NE SW, Section 24-1s-3w. Carter Oil Co. and others' rig is up for No. 1 J. Hooks, NW cor. SE NE, Section 24-1s-3w. George Pace has the rig up for No. 2 Mitchell, SW cor. NW NW, Section 30-1s-2w. M. G. R. Oil Co.'s No. 2 Mitchell, SE cor., Section 24-1s-3w, has been completed for 817 bbls. in sands 2,191-2,335 feet.

Cherokee County

Weaver & Proctor's No. 1 Benge, SW cor. NE NE NW, Section 8-14-21, is drilling deeper at 800 feet.

Creek County

Imo Oil Co. and others' No. 1-A Coonrod, NE cor. SW SE, Section 4-19-9, is spudding. Sample & Mann and others moved a machine in for No. 2 Saad, SW cor., Section 17-19-9. O. M. Irelan has the rig up for No. 1 Bible, NE cor. NW SW, Section 20-19-9. Sidwell Drilling Co.'s No. 1 Fee, NW cor. SE NE, Section 12-18-8, is a rig. Hartman & Wright and others moved a machine in for No. 1 McKellop, CEL NE NW, Section 26-17-10 Johnson Oil & Refining Co.'s No. 2 Henneha, SW cor. SE, Section 11-19-9, has been abandoned at 2,192 feet. Jackson & Wise's No. 1 Jackson, NW cor. NE SW, Section 14-19-9, is dry and abandoned at 2,236 feet. H. U. Bartlett's No. 1-A Sneed, CEL NW NW, Section 20-18-9, has been completed for 3,500,000 feet of gas in sand 2,595-2,609 feet. William Sherry and others' No. 1-A Gooch, C SW NW, Section 21-16-11, made 3,250,000 feet of gas from sand 2,175-82 feet. Campbell & Cothran and Deep Rock Oil Corp.'s No. 1 Kimble-Reading, SW cor. NW NE, Section 15-14-10, has been completed for 50 bbls. in Dutcher sand 2,697-2,707 feet after plugging back from Wilcox sand 3,263-91 feet.

Haskell County

A. W. Ault and others' No. 1 Hall, NW cor. SW SE, Section 14-9-19, is drilling at 550 feet.

Kay County

Blankenship and others made location for No. 1 Hollenbeck, SE cor. NE SE, Section 18-27-2.

LeFlore County

Red Bank Oil Co.'s No. 1 Fee, SE cor. SW NW, Section 23-9-24, has been completed for 6,000,000 feet of gas in sand 5,401-21 feet.

Marshall County

R. L. Keener's No. 1 Barnard, NW cor. NE SW, Section 28-5s-6, is dry and abandoned at 1,360 feet.

McIntosh County

Brown & Brown's No. 1 C. Estos, SE cor. NE NW NW, Section 35-11-15, has drilled to 1,146 feet and shut down. Deep Fork Oil Co.'s No. 2 M. Williams, C NE SE, Section 34-12-14, made 500,000 feet of gas from sand 742-53 feet. A. Moffitt's No. 1 J. Taylor, NW cor. NE SW, Section 29-12-15, is dry and abandoned at 2,382 feet.

Muskogee County

Singer P. & S. Co.'s No. 2 Charles, SW cor. NE SW, Section 6-15-15, is an old well drilling deeper at 1,157 feet. Taylor & Geiger's No. 1 Jackson, SW cor., Section 9-15-15, is rigging up. H. Smith's No. 9 Pouncil, SE cor. NW SE NE, Section 25-15-15, is spudding. Western D. & E. Co. has a machine on the location for No. 1 Bailey, NW cor. SW SE, Section 11-15-17. No. 4 Fields, NE cor. SW. Section 9-15-18, is also a machine. J. R. Parks' No. 1 Lewis, NW cor. SE SE, Section 15-15-18, is drilling at 55 feet. Mack Drilling Co.'s No. 1 Rowe, SE cor., Section 27-16-15, has been deepened to 1,926 feet and abandoned. B. H. Young and others' No. 1-A Richards, C NE NW, Section 34-16-15, is dry and abandoned at 1,268 feet. Taylor & Geiger's No. 1-A Thompson, SW cor. NW NW NE, Section 17-15-15, has been completed for 500,000 feet of gas in sand 835-63 feet. C. F. Finefield and others' No. 1 Murrell, SE cor., Section 5-15-18, made 35 bbls. in sand 984-1,016 feet. J. R. Parks' No. 2 Rentie, C NE SW, Section 15-15-18, has been abandoned at 1,345 feet. R. F. Ray and others' No. 1 Canard, NW cor. SW NE, Section 20-15-18, made 2,500,000 feet of gas from sand 1,328-48 feet. Wilson & Johnson's No. 2 Jordan, NE cor. SW SE, Section 14-13-18, has been abandoned at 779 feet. Bower and others' No. 1 Griffin, NW cor. SE NE, Section 23-13-18, is dry and abandoned at 995 feet. Indian Territory Illuminating Oil Co.'s No. 1 Wilson, SW cor., Section 31-12-19, made 1,500,000 feet of gas from sand 605-20 feet.

Okfuskee County

F. Cussack and others' No. 15 Smith, SW cor. SE NE, Section 11-11-11, has been abandoned at 3,552 feet.

Okmulgee County

Clarmont Oil Co.'s No. 3 Replogle, CWL NW NE, Section 12-15-12, is spudding. Speary Brothers' No. 1 Simmons, NW cor. NE NW NW, Section 29-15-12, is spudding. W. C. Newman moved a machine in for No. 1-A Brunton, SE cor. NE NW, Section 14-14-13. Keithly & Smith's No. 6 Harris, CSL NE SE, Section 1-14-14, is a machine. Whitcomb and others' No. 2 Harris, SW cor. NE NE, Section 1-14-14, is drilling at 300 feet. Eagle-Picher Lead Co.'s No. 2 Sullivan, C NW SE, Section 8-12-12, is drilling at 700 feet. Kirkland & Son's No. 4 Brown, CNL SW SW, Section 9-15-13, has been completed for 12 bbls. in sand 1,971-98 feet. Independent Oil & Gas Co.'s No. 1 Tucker, SW cor. SE NW, Section 9-15-14, is a dry hole at 2,342 feet. Elm Oil Co.'s No. 24 Rentie, SE cor. SW SE, Section 13-14-14, made 15 bbls. in sand 1,020-91 feet.

Pittsburg County

Apex Oil Co.'s No. 1 Walker, NW cor. SE, Section 18-7-13, has been abandoned at 1,600 feet. Central States Power & Light Co.'s No. 2 Curry, SW cor. SE SE, Section 9-7-18, made 8,000,000 feet of gas from sand 1,910-80 feet. No. 2 Koehler, SW cor., Section 11-7-18, has been completed for 25,000,000 feet of gas in sand 1,810-90 feet. Nolan & Nolan's No. 1 Kohler, NE cor., Section 15-7-18, gauged 14,000,000 feet of gas from sand 1,850-1,978 feet. Cities Service Co.'s No. 1 Featherstone, C NW SE, Section 9-6-17, is dry and abandoned at 3,004 feet.

Pontotoc County

Benedum-Trees Oil Co.'s No. 1 Wallen, NW cor. SE SE, Section 28-5-5, Madill Pool, swabbed 8 bbls. from sand 2,399-2,424 feet.

Tulsa County

Holmes & Burton and others' No. 1 Hawkins, NW cor. SW NW, Section 29-19-10, is drilling at 1,200 feet. Owens and others' No. 1 Warner, NW cor. SE SW, Section 33-18-14, is a machine. Murray and others' No. 1 McIntosh, C NE SW, Section 17-19-14, has been abandoned at 1,320 feet. Preston and others' No. 1 Perryman, NE cor. NW NW, Section 4-17-14, has been completed for 25 bbls. in sand 1,492-1,513 feet.

Wood County

Bu-Vi-Bar Petroleum Co. and others' No. 1 Fee, SE cor. SW, Section 10-25-15w, is dry and abandoned at 6,104 feet.

Wagoner County

J. A. Murphy's No. 1 C. Simmons, NE cor. NW, Section 34-18-15, has set 8-inch pipe at 1,270 feet. A. H. Secrist's No. 2 Barnett, SW cor. SE NW, Section 34-17-16, is drilling at 650 feet. William La Pierre's No. 1 Scott, NW cor. NE, Section 3-16-16, is drilling at 235 feet. Coffey and others' No. 1 Cruel, CSL SW NE, Section 10-17-16, has been abandoned at 718 feet. J. W. Edwards' No. 2 Chockley, SE cor. NE, Section 21-17-16, made a 25-bbl. well in sand 893-98 feet. J. W. Edwards' No. 1 Jackson, NE cor., Section 4-16-16, is a dry hole at 977 feet. Duke and others' No. 1 Brown, NE cor. SW NW, Section 36-16-17, has been abandoned at 868 feet.

ROCKY MOUNTAIN AREA

(Continued from Page 70)

SW, Section 31-18-38, on the west side of the pool, half a mile south and two-thirds of a mile northwest of the nearest producers, is drilling at 3,314 feet in anhydrite. It topped brown lime at 2,847 feet and had first gas at 2,857 feet and first oil at 3,249 feet. Elevation is 3,642 feet.

Eunice Area—Lea County

Atlantic Oil Producing Co.'s No. 1 Coleman, SW NE NW, Section 17-21-36, is digging cellar. This was a location last July and then temporarily abandoned and has been revived. It is about one-half a mile northwest of the producer completed recently by Tidal Oil Co. in its No. 1 Coleman. Tidal's well, which is in the SW cor. NE, Section 17-21-36, was completed at 3,968 feet after plugging back from 4,175 feet. The pay was at 3,853-3,968 feet and the well made 970 bbls. of oil and 4,000,000 feet of gas the first 24 hours. Elevation is 3,631 feet. Shell Petroleum Corp.'s No. 1 Coleman, NW cor. SE, Section 17-21-36, an offset on the south to Tidal's well, spudded on October 28 and is drilling at 35 feet in sand. Continental Oil Co.'s No. 2 A. E. Meyers. SE cor. NW, Section 17-21-36, an offset on the west to Tidal's well, is building rig. Continental's No. 1 William Meyers, SW cor. NW, Section 28-22-36, is bottomed at 3,915 feet with a hole full of sulphur water and will plug back to the gas sand. Ohio Oil Co.'s No. 1 State-McDonald, SW NW SW, Section 15-22-36, is bottomed at 3,904 feet and rigging up cable tools to plug back.

Caprock Area—Lea County

Texas Production Co.'s No. 1 Bridges, SE cor. NW, Section 17-17-34, is drilling at 2,200 feet.

Lovington Area—Lea County

Galt, Brown and others' No. 1 State, SW NW NW Section 9-15-35, is drilling at 1,830 feet in red beds and shells.

Eddy County

Getty Oil Co.'s No. 6 Dooley, C NW SW Section 24-20-29, Twin Mounds district, is cementing casing at 1,045 feet, below a gas horizon topped at 1,001 feet and estimated at 10,000,000 feet. Lockhart & Co.'s No. 1 Livingston, SW SW Section 23-24-28, Pearce Canon, is drilling at 500 feet.

Quay County

Hudson Oil Co.'s No. 1 Wetsel, SE SW Section 29-12-33, which spudded in and shut down at 85 feet last September, is reported resuming.

San Juan County

Murchison Oil Co.'s No. 2 Angel Peak, SW SE Section 11-28-11, Kutz Canon, is bottomed at 1,840 feet on top of the Picture Cliff and is standardizing. Kutz Canon Oil & Gas Co.'s No. 1 Day, SW cor. Section 20-28-10, is recementing at 2,012 feet. Continental Oil Co.'s No. 24, SW NW Section 1-29-19, Rattlesnake, is drilling at 3,700 feet.

Valencia County

Thomas B. Harlan and others' No. 1 Harlan Ranch, NE cor. NW Section 5-6n-2e, is drilling at 3,675 feet in its second hole.

COLORADO

Weld County

Contrary to expectations and plans announced by officials last week, work was not resumed on Platte Valley Petroleum Co.'s No. 1 Patterson, NE SE NW Section 24-6n-61, on the Greasewood Dome in Weld County, northeastern Colorado, on November 1, and no important change has taken place in conditions at the well. Furthermore, it is very doubtful if any attempt will be made for several weeks to drill it in. Frank Kirchoff, president of the American National Bank, said yesterday nothing more would be done on the well until everything was ready for completing it with the minimum risk as to safety, for taking care of the oil when it is produced and for going ahead with some definite plan of operation. At present the hole is bottomed at 6,667 feet in shale, supposedly just above the Muddy, the first sand of the Dakota series, with 4¾-inch casing 32 feet off bottom. It is now making an average of five heads a day and producing an average of 160 bbls. of oil daily. Continental Oil Co. has completed the work of setting up a 5,000-bbl. tank to supplement the two 500's and the gunbarrel tank and is operating three trucks 24 hours a day between the well and the Union Pacific Railroad at Orchard. The first tank car of oil from the well was shipped from Orchard on October 31 and went to the Continental's new refinery north of Denver. The Continental is taking the oil under a temporary arrangement and it was stated by a Platte Valley official that no permanent arrangement for the marketing of its crude has been made.

In fact, this is one of the reasons said to be back of the delay in drilling in the well, as is also the desire to get its leases in the best possible shape. This delay also is generally satisfactory to the major companies, who had taken practically no steps to obtain protection acreage around the well during its drilling stages or to work out the geology. There are crews representing a number of companies in the field, not only in that district, but throughout eastern Colorado. Most of them are not disclosing their identity and they are keeping out of each other's way as far as possible. One crew of 35 men made its appearance this week and then scattered throughout eastern Colorado, but they were careful not to reveal any information as to who they are or what interests they represent. Surface indications of structures are hard to find and considerable posthole drilling is being done in several districts. One crew was said to be using a machine brought from California that cuts a 24-inch hole into which a man can enter and examine the strata.

Morgan County

Indian Territory Illuminating Oil Co.'s No. 1 State, C NE NE Section 16-1n-57, on the Fort Morgan anticline in Morgan County and to the southeast of the Platte Valley well, is the most closely watched wildcat in the State on account of the discovery to the northwest, but little information is given out except as to drilling depths. It was reported on November 1 as drilling at 3,530 feet. It is generally expected this well will reach the Dakota at around 1,000 to 2,000 feet shallower than the Platte Valley discovery.

Washington County

Farther south of the two operations mentioned, but on the same general fold, is the Middlemist Oil Co.'s No. 1 Middlemist, SE SW SE, Section 14-4s-56, Fred R. Zimmerman of Milwaukee, former governor of Wisconsin, has taken over the well for completion and preparations are being made to resume under his name. The 15½-inch was cemented several months ago at 1,030 feet and a little hole was made below that depth. A string of 2,000 feet of 12½-inch is being moved in.

Larimer County

Continental Oil Co.'s No. 3 Scott, SW SE Section 6-9-68, Wellington Dome, is shut down for orders at 4,637 feet. This well was a producer in the Muddy sand at 4,345 feet and was being deepened to test the Lakota sand. It found water in the Dakota, the second sand of the series, and topped the Lakota at 4,612 feet and is reported to have found water in that horizon. Erbe Oil Co.'s No. 1 Maxwell, SE NE NE Section 25-8n-70, Bellvue district, is installing rotary equipment to resume at 125 feet. C. Leonard Smith's No. 1 State, SE cor. Section 36-12n-70, Sand Creek, is drilling at 210 feet after being shut down for repairs.

Adams County

Nettie M. Slatt's No. 1 Hills, SE cor. Section 27-3s-64, Watkins district, is drilling at 2,500 feet.

Baca County

The A. R. Jones Oil & Operating Co.'s No. 1 Boice Cattle, NW NE Section 23-(Tract 50)-34-42, Miles Camp structure, is resuming after being shut down for several weeks and is drilling at 4,012 feet with a hole full of salt water. A water sand, which correlates with the sand in which a showing of oil with salt water was found in the Magnolia-Ramsey

operation farther south on the Oklahoma side, was topped at 3,720 feet.

Fremont County

Standard Oil Co. of Colorado's No. 1 Tiger, SE NW, Section 26-19-69, in the South Florence extension, was dry and abandoned at 1,604 feet, and Hammond & Rocco's No. 1 Beltramo, NW SW SW Section 1-19-70, in the Canon City district, was dry and abandoned at 2,548 feet. Caraway & Focken's No. 2-A Griffith, NE W Section 5-20-69, is shut down at 2,760 feet and will drill deeper. Anderson Oil Co.'s No. 3 Beltramo, SW SW Section 1-19-70, is shut down at 3,400 feet, and Vogel-Raddatz Corp.'s No. 24 Travis, NW NE Section 28-20-69, is shut down temporarily at 825 feet.

Archuleta County

Standard Oil Co. of Colorado's No. 1 Wirt, SW SE NW Section 34-33n-1e, Chromo Dome, is spudding. This location is half a mile north of its No. 1 Fitzhugh, NW SE SW Section 34, which is bottomed at 502 feet and showing some oil which the company estimates would amount to 5 to 10 bbls. a day if pumped. The Fitzhugh well is waiting for casing. Same company's No. 1 Crowley, NE cor. Section 2-32-2e, Price Dome, which at 247 feet in sand showed for about 500,000 feet of gas, is running casing. A gate will be installed and the gas will be saved for fuel. The company contemplates using the gas for domestic consumption in towns in that area when a larger supply is developed. It is moving in for its No. 1 Brooks, on the bank of the Navajo River and 1½ miles northeast of its No. 1 Crowley.

La Platta County

Murchison Oil Co.'s No. 1 Doescher, SW NW Section 29-33-13, Dry Mesa, is bottomed at 1,000 feet, where the drill stem broke off. McGarr Petroleum Corp.'s No. 1 Sanchez, SE cor. NE Section 27-33-12, is shown down at 3,320 feet, and the E. B. Klem Petroleum Co.'s No. 1 Olbert, NW SW Section 9-35-12, is drilling below 2,741 feet.

Montezuma County

Mesa Verde Ranch Co.'s No. 3 Haller, NE SE SE Section 33-36-14, Mount Lookout Structure, topped the Dakota at 712 feet and found 52 feet of saturated sand. There was practically no pressure and the oil came into the hole in small quantities. The oil tests 36° gravity. The company drilled the first well in this district for water, but encountered gas in the Dakota. The second well also yielded gas and the third showed oil but no gas. The last named will case off the sand and continue to the Sundance.

Rio Blanco County

Texas Production Co.'s No. 1 Potter, C NE SW Section 30-2n-96, White River structure, which was drilled to 5,984 feet last spring when the drill stem broke off, is shut down indefinitely. Following loss of the drill stem, a string of 2½-inch tubing was run and a packer set at 5,455 feet to test the several shows of gas below that depth. Since then the well has been opened for short intervals to let it blow to clean itself of the mud used in drilling. Before shutting down, it was opened for 19 minutes and made 25 gallons of oil and 5 gallons of mud in that period. The pressure was 1,700 pounds. Ohio Oil Co. closed a deal several months ago to drill a Pennsylvanian test on the Meeker structure in Rio Blanco County, but it is doubtful if it will get under way before spring. Texas Production Co. has acquired two permits of 2,560 acres each on the Big Beaver Dome in Townships 1n and 2n, Ranges 91w and 92w, to the northeast of the Meeker Dome, but has no plans for drilling at this time.

Moffat County

Midwest Refining Co.'s No. 24 Hannewalt, NE SE SE Section 4-6n-92, Bell Rock structure, after sidetracking two bits and reaching old bottom at 3,040 feet, again lost a bit and it has been decided to complete the well as a gasser. It is the discovery well on the dome and had 32,000,000 feet of gas a day in a 25-foot sand at 2,900 feet in the Mesa Verde. It had shows of oil and more gas both above and below that horizon, but could not get to the objective Morapas sandstone. It is probable another well will be drilled. The Texas Production Co.'s No. 12 Knowlton, SW SE Section 33-5n-91, Moffat Dome, is bottomed at 4,592 feet in the Sundance and is plugging back to shut off water at 4,591 feet. It probably will make a 50 to 75-bbl. well. Same company's No. 4 Wick, NW NW Section 10-4n-91, is bottomed at 4,557 feet and waiting for coment to set. It is an old well being deepened to the Sundance. Mountain Fuel Supply Co.'s No. 2 State, SE NE Tract 37-12n-100, Hiawatha Dome, is drilling at 815 feet. Ohio Oil Co., through its acquisition of the Transcontinental Oil Co., becomes a partner of the Texas Production Co. in the producing of the Knowlton lease on the Moffat Dome. The Transcontinental owned a half interest in the lease which is being operated by The Texas Company.

Routt County

Texas Production Co.'s No. 4 Carstarphen, NE NW NW Section 5-6n-86, Tow Creek, has a good show of oil in shale at 3,277 feet and will test. It is estimated at 200 bbls. a day. The well flowed when the tools were pulled. This location is about one-sixth of a mile northwest of No. 3 Carstarphen, the nearest producer.

WYOMING

Weston County

The Osage Field in Weston County in the northeastern part of Wyoming had a good completion this week in the Lambie Oil Co.'s No. 3 Bock, SW cor. NE Section 14-46-64, which found the sand at 1,750-60 feet and came in flowing 600 bbls. a day. Pipe line runs and deliveries to refineries in the Osage district aggregated 45,000 bbls. in October, which compares with 38,500 bbls. in September, 42,886 bbls. in August and 32,500 bbls. in July. Osage Trust Co.'s No. 8, NW cor. SE Section 14-46-64, is bottomed at 1,730 feet and running the 6⅝-inch. This well is south of the producer just completed by Lambie Oil Co. Yellowstone Petroleum Co.'s No. 2 McCullough, NW NE Section 23-46-64, is drilling at 1,500 feet, and Dernacher, Bock & Monahan's No. 1, SE cor. SW Section 11-46-64, is drilling at 300 feet. Osage Trust Co.'s No. 9, SE cor. Section 14-46-64, cemented 8¼-inch pipe and shut down, and its No. 10, NW SE Section 14-46-64, is shut down. Henderson, Garbarino and others' No. 1 Bock, SW cor. Section 2-46-64, set 6¼-inch at 1,688 feet, and Decker Oil Co.'s No. 1, NE NE Section 1-45-64, is drilling at 1,800 feet.

Converse County

Ohio Oil Co.'s No. 5 Jones, Section 9-33-76, Big Muddy, is drilling at 3,342 feet in black shale, and Continental Oil Co.'s No. 50 Whiteside, SW SW Section 9-33-76, is drilling at 3,345 feet in blue shale.

Natrona County

Midwest Refining Co. and others' No. 11 Middy, NE NE, Section 23-25-79, Midway Dome, is pumping an average of 150 bbls. a day at a total depth of 5,207 feet after plugging back from 5,215 feet to shut off bottom water. It is not yet listed as a completion, as it may be given a small shot or drilled a foot or two deeper. Same company's No. 11, NW NW Section 32-34-77, Geary Dome, is rigging up to spud. Core drilling is in progress on the North Geary Dome to work out the structure. This dome lies between the Midway and Geary structures and is one of the three to be tested under the co-operative development agreement. The Empire State Oil Co.'s No. 6, SE cor. Section 12-33-83, Iron Mountain dome, was completed at 1,410 feet with an initial production of 67 bbls. Cuyler Oil Co.'s No. 1, SW Section 24-36-85, Powder River, gauged 10,000,000 feet of gas in the Frontier at 1,302-20 feet with a pressure of 580 pounds, and will be completed as a gas well. Two additional wells will be drilled, one on the Ogden tract, half a mile to the north, which will go to the Frontier, and the other to be a test to the Dakota series, the original objective in the first well.

Park County

Resolute Oil Co.'s No. 1, SW NE Section 17-57-101, Badger Basin, which now holds the record for deep wells in the Rocky Mountain area, is drilling at 7,900 feet. Through the acquisition of the Transcontinental Oil Co., Ohio Oil Co. has come into some acreage on the Little Polecat Dome, including No. 1 Trans-Ark, Section 30-57-98, which was completed as a 5,000,000-foot gas well in 1923. The Ohio company is laying an 8-mile 3-inch line to tie the well in with the Powell-Lovell system. The gas is sweet and contains very little sulphur. Midwest Refining Co.'s No. 31 Rosenberg, SW cor. SE Section 24-58-98, Frannie Dome, is drilling at 2,648 feet in black shale. The 8⅝-inch is at 2,647 feet. Texas Production Co.'s No. 2 Sonners, SW SW Section 20-51-100, Oregon Basin, is drilling at 2,715 feet. Continental Oil Co.'s No. 27-Elk-2, NE NE Section 24-58-100, Elk Basin, is shut down at 1,473 feet for repairs from fire.

Hot Springs County

Midwest Refining Co.'s No. 8 Weeks, NW SE, Section 6-44-98, Wagonhound, is bottomed in sand at 4,490 feet and straightreaming at 4,404 feet.

Carbon County

Baggs Oil Co., in which C. E. Bivins, Marvin James and others are interested, has made a location for its No. 1 Christianson in the NW NW Section 7-12n-92, on the Baggs structure, 5 miles southwest of the Red Feather's No. 1, the deep test. It will go to the first gas sand to build up a supply for domestic uses in Boggs, and for a small absorption plant. Red Feather Oil Co.'s No. 1, SW SW Section 35-13-92, is preparing to resume at 2,300 feet. This well had gas in upper horizons and is going deeper to explore for oil. Producers & Refiners Corp.'s No. 3, SE NW Section 2-19-88, Hatfield Dome, is bottomed at 4,343 feet and fishing for tools, and its No. 4, SW SE Section 7-26-89, Wertz Dome, is bottomed at 3,396 feet and drilling up bailer. Midwest Refining Co.'s No. 27 Union Pacific, SE SE Section 11-20-81, Elk Mountain, is drilling at 455 feet in black shale.

Fremont County

Texas Production Co.'s No. 1 State, SW SW Section 36-34-95, Alkali Butte, is bottomed at 4,485 feet and working on pipe which is stuck. Kinney-Coastal Oil Co.'s No. 1 Dykeman, SE SW Section 22-3n-1w, Pilot Butte, is recementing below the gas sand in the Dakota formation, the first job failing to hold. Producers & Refiners' No. 2, SE NW Section 33-34-92, Muskrat Dome, cored to 4,631 feet in sand, reamed to 4,610 feet and is waiting for test, and its No. 10, NW cor. Section 14-32-95, Sand Draw, cored to 3,650 feet in sandy shale and has reamed to 3,631 feet.

Sweetwater County

Mountain Fuel Supply Co.'s No. 1 Cappers, SW NE Section 2-19-104, North Baxter Basin, is drilling at 3,208 feet.

Lincoln County

Mountain Oil Corp.'s No. 1 State, NE cor. Section 36-25½-115, Wyoming structure, topped the lime of the Park City formation at 1,105 feet and drilled to 1,112 feet when it stopped to ream and lower 13⅜-inch to bottom for a formation shutoff.

IDAHO

Crystal Dome Oil Co.'s No. 2, SW SW Section 32-10n-4w, Fayette County, Idaho, which blew in at 1,865 feet in September as a gas well, is shut down pending some adjustments under way. Idaho-Oregon Petroleum Corp.'s No. 2, NW SE Section 33-9n-5w, on the property of the Idaho Canning Co. in the town of Payette, has contracted for completion of the well which has been standing at 1,800 feet with 8¼-inch on bottom. This well blew in in February, 1929, at 1,240 feet and made considerable gas until it bridged. It subsequently was deepened. The Idaho-Oregon company will go 10 miles north of Payette where it has blocked up 5,000 acres and will drill a test in the near future. Idaho Natural Gas Co. is rigging up in its No. 1, NE Section 25-18-16, across the line in Oregon 3 miles south of Ontario. Grand Teton Oil Co.'s No. 1 Blevins, Section 33-5n-44, Teton County, is waiting for rotary equipment at a total depth of 3,304 feet. The equipment has passed through Idaho Falls on its way to destination.

MONTANA

The Glacier Oil Co. found a large gasser in its No. 1 Omsberg on Section 33-35-5, Glacier County, near Cut Bank. This is the third wildcat in this new field to come in as a large gas well and definitely opens up a gas field in northern Montana. The gas was found in the Stray sand and the well is estimated at 20,000,000 feet.

The Texas Pacific Coal & Oil Co.'s test in a wildcat area in Golden Valley County, on the Woman's Pocket Dome, Section 21-8-21, found a very large flow of water about 1,540 feet and the circulation mud came up in the bed of the creek near the rig. The water was in the Kootenai sand and 140 sacks of cement and clay were used before the flow was shut off. The objective of this well is a sand about 3,000 feet and the 15-inch pipe will be reset and cemented through the Kootenai. The well is being drilled with a rotary outfit.

Sunburst had one completion, the Thompson Oil Co. brought in its No. 1 Dessel, Section 20-34-1, in the Madison and found a dry hole. The Ellis was also dry and the well is being abandoned. The deep test being drilled by the Potlatch Oil Co. on the Adams lease, in Sunburst Field, is shut down and the company announces the work will not be resumed until spring. This company closed a deal for 960 acres adjoining the Adams lease, consisting of the Troy Sweetgrass holdings with one gas well. The deep test

(Continued on Page 224)

STORE BY-PRODUCT GAS IN NATURAL GAS WELLS

PITTSBURGH, Pa., Nov. 8.—Utilizing natural rock reservoirs hundreds of feet underground for storage of artificial gas, the Carnegie Steel Co. has pioneered a new step in industrial economy.

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Chicago Market Is a Little Stronger

Good Consumption of Gasoline Over Week-End. Movement of Furnace Oils Steady. Zero Oils Firmly Held

By John B. Waldo

CHICAGO, Nov. 10.—This territory had another splendid day for motoring and the number of cars on the highways was as large as during the middle of summer. Trips were short in most cases but the gasoline consumption on Sunday in and near this city must have been large. The demand for gasoline in this market today was only fair but the Monday business has been light of late, jobbers making their check up and ordering in the late afternoon if they were in need of gasoline, if not on Tuesday or Wednesday. Prices were held with considerable firmness and the market was a little stronger for all grades. The majors continued to hold for 5¼ cents to spot buyers but the open market was steady at 4¾ to 5 cents for fuel specification gasoline, blended material and off quality selling for slightly less. The demand for the higher tests has been a little more active and the tendency is towards better business in these gravities.

Refiners who have sold much gas oil and distillate to their customers on contract state that the movement of furnace oils is steady and is keeping their stocks in good shape. There has been no real heavy buying of furnace oils this season as there has been no real cold weather but the demand is fairly large and is steady. Kerosene was in light demand but at unchanged prices this morning. The demand for heavy industrial fuel oils continues disappointing. Inquiries were limited both as to number and quantity wanted.

Prices for the zero oils were firmly held with light offerings. Refiners report a light movement in lubricating oils for present needs but state that they are closing contracts with compounders for their refinery stocks right along.

There was a little more strength in the gasoline market last week. Prices for U. S. Motor gasoline were advanced by refiners an eighth to a quarter cent, and at the close of the week the low price by refiners for resale was 4½ cents with a very small quantity avilable here and there at 4⅜ cents. These prices were quoted direct to jobbers by some refiners. The jobbers were resisting any advance and going back to quotations, some of them a week old when ordering. In some cases they secured what gasoline they needed at the old price and in some cases the seller refused to consider a price a week old as still in force and insisted on a slight advance. There was no heavy buying of gasoline nor even a fairly liberal demand. Jobbers are buying just what they need and no more and not buying for any advance requirements. They figure that even if the market does advance, it will be only a fraction of a cent and that they will still have an ample margin of profit. The average jobber has been quoted advanced prices, has refused to buy and has seen the market decline to still lower levels all this summer, so that he has little faith in any quoted advance.

Outside Competition

The major refiners declined their spot price for U. S. Motor gasoline, Group 3 basis, to 5¼ cents. There is a good deal of talk in the market about an attempt to advance the price to resellers to 5 cents and thus establish the 5¼-cent price as the open market quotation. This could be very easily done by a united front among the refiners but this united action seems to be impossible of accomplishment. It might be possible for the refiners in any refining center to secure action in their own district but there are no important refining centers which are not capable of refining more gasoline than can be used in their own restricted territory and each refiner is seeking for business at points more distant from his own refinery where he is obliged to meet local competition. There are refineries with ample capacity in this city to supply all the petroleum products required here, yet outside refiners are constantly competing in Chicago for a part of the business, and the result is an absolute lack of success in any attempt to secure uniform price action. There has been heard during the past week much complaint regarding the lack of business by some of our refineries and the thought is strong in the mind of the sales management that they are suffering the loss of some of the business which should be theirs through outside refinery competition. Prices were quoted last week by middle states refiners which, while supposed to be on a parity with Group 3 prices, really figured a slight advantage to the local plant as for example 6.6 cents f.o.b., refinery quoted by plants within the Chicago switching district.

Some time since one of the owners of a local plant came and read the management a lecture on the prices quoted, the burden of his remarks being that the manager of the plant did not have to quote under the Group 3 prices but could secure some premium because these jobbers were located in his own back yard and he could make deliveries and render other services which could not be rendered by the distant plants The orders were given and the new prices went out. Orders dwindled until the refinery output was so largely in excess of the sales from day to day that it became necessary to close down the plant. The gasoline was sold at competitive prices and since that time, this refinery has been quoting at or under the group market but never above the going price. Transportation is easy, cheap and quick now, and the result has been that it is possible for refiners to sell at longer distances from their plant. To the present means of transportation there will shortly be added the carrying of gasoline by pipe line for thousands of miles. The freight on a gallon of gasoline from Group 3, to the Chicago district is now .0238 cent a gallon. The cost of delivering gasoline between the same points by pipe line, is estimated at 1⅛ to 1½ cents a gallon. The railroads have applied for permission to reduce the rate on gasoline from 35 to 27½ cents a hundred weight which would give a freight cost of .0182 cent per gallon. The result of these reductions in the cost of gasoline shipments will be to extend the distance to which the material can be shipped, practically moving the refinery that much nearer to its trade. The volume of gasoline which the Great Lakes pipe line can deliver to its terminals is approximately 10 per cent of the gasoline consumed in the territory which it will serve. This is of itself not an alarming quantity but the success of the line means increases in capacity and additional lines.

May Revise Business Methods

It is not improbable, but very possible, that as the result of this increased ease of transportation of the leading product from crude, that we shall have a number of changes in the method of doing business. One of these is beginning to be shown already and that is a tendency to quote prices as, f.o.b. refinery, instead of f.o.b. Group 3. Those who are advocating the plan claim that it really is a clearer way of quoting and avoids a number of items which sometimes come up as very irritating subjects for settlement between the refiner and his customer. Recently a refinery quoted a price of $1.35 a barrel for fuel oil f.o.b. refinery which is located in the Chicago switching district. Two other refinery men were asked how the price compared with their prices which were quoted Group 3 and they figured the price, one as 47½ cents, Group 3, and the other as 52½ cents, Group 3. One of them must have been wrong. If the man who figured it as 47½ cents had reduced his price to meet the competition of the Chicago refinery he would have been cutting needlessly. The oil was a 16-20 zero fuel oil, low viscosity and low sulphur content, a fine piece of merchandise. There are some of the larger local refineries who will quote either way and they claim that the preference of their customers for a quotation based on the refinery is growing.

Price Cutting Discussed

The situation in Detroit appears to some to be a sort of example of what might happen anywhere if the local dealers are too free in using the knife and cutting prices. However in this particular situation a local price cutter and a local refiner are unable to agree on anything, even their opinion each of the other. Calling each other names is not going to settle the trouble. As it is, gasoline is being sold at 8 gallons for $1 and most of the dealers are simply maintaining a 3-cent differential between the price of the regular and that of Ethyl Gasoline if they happen to handle that commodity. The Standard Oil Co. (Indiana) in announcing that it would meet the latest cut, excepted its Red Crown Ethyl from the reduction which in the ordinary grade was from 7 to 8 gallons for $1. The reduction of Ethyl, when the regular grade is reduced, is explained as necessary by one company which operates over 100 stations. The management claims that if the price in any locality is reduced 2 cents a gallon on the ordinary white grade and Ethyl is still held at 3 cents above normal, that the premium would be so large that motorists would refuse to buy the premium gasoline. The motorists argue that if Ethyl Gasoline is worth 3 cents more than the regular that is all it is worth, for it is only a mixture of a chemical with the regular gasoline. Some oil men have commented on the fact that with the growing popularity of Ethyl Gasoline, it might prove a blow to the trackage stations which, as a prominent oil man said last week, were the only ones that were making any money. But if this rule prevails there is no reason from barring the owner of a trackage station from being able to purchase all the premium gasoline he wants to buy. In fact there is less prejudice against the price cutter so long as he is not a reckless disturber of the market than there was even a year ago. At least it seems so to many in the industry who view the situation from a general and impersonal standpoint. The plan of one price to all is hardly possible in such a vast industry. Circumstances vary so that it seems often necessary and justifiable to make different prices in various localities and to different classes of buyers.

Change in Custom Demand

The demand for the higher gravities has failed to show the usual increase that came in years past, when the weather turned chilly. It used to be a custom with many motorists to change from motor grade to the 60-62 or 64-66 gravity at a certain date but now many of them use Ethyl Gasoline or some other make of premium motor fuel the year around and do not need to shift their carburetors for winter driving with a different material. The 60-62 400 grade has been pressed for sale at prices which were practically once one eighth of a cent above the price of the motor grade and the asking price being only one-fourth of a cent. Through some change in the demand or too large a supply, refiners have been overstocked with this gravity and have been glad to move it at some price. The 64-66 375 gravity has been in better shape as regards to stocks at the refineries and the prices have been a little better but the export demand has been less active and these prices have been not over a half cent higher than the U. S. Motor grade. There has been a steady if not large demand for blending naphthas and natural gas has also moved fairly well for this market. Prices have been lower on both the blending naphthas and natural gasoline.

Kerosene continues to sell but in such a quiet way and in such limited quantities, that the market is almost unaware of anything doing. Prices are practically unchanged in the spot market.

Sweet and Sour Furnace Oil

The furnace oil demand has not struck its winter stride, but there is a steady movement which is improved by each cold spell when the period of lower temperatures is for more than a single day. Most distributors who work on contracts have accumulated more or less stock during the past month and occasionally one has written in to have shipments suspended until the demand improves and he can take in the oil ordered. The demand has been running quite noticeably to the heavier grades of domestic burner oil such as the 28-30 gravity and down to the 24-26 or 22-26 gravity. These are of course zero oils and must be sweet. It seems impossible to make refiners who are rather new to this market, understand the importance of odor in domestic furnace oils. With the consumer it is a matter of prime importance. He can get along with almost anything else a little off specification, but if the odor is bad the oil man hears from it very promptly. An additional trouble with the odor from burner oils is that it seems to hang on much longer than ordinary bad odors. The reason for this may be that the home in winter is not ventilated as well as it is in summer. One southwestern refinery has been having quite a bit of trouble with cars of gas oil shipped to this territory. The supply of zero oils is so limited and closely held in a few hands, that a promise to deliver zero gas oil or distillate is bound to attract business. It is not unlikely that the refiners considered the oil shipped as sweet oil, for they are not so particular in the Southwest as they are here where the homes are tightly built and heat is used all of the day in winter. The prices are strongly held on all desirable grades of home burner oil. Several of our local refiners are out of the market on all grades and this is bad for the local seller or the local consumer as he is less certain of his supply and of the quality of the oil which may be supplied.

Gas Oil

The feeling that U.G.I. gas oil may weaken a little still continues and some think that it has weakened a little during the past week. The chief reason for this is the fact that several of the gas companies supplied their monthly requirements at 2 cents or a very little more. At least several bids of 2⅛ cents, or a trifle less, have been rejected as too high. The theory of those who have anticipated lower prices has been that with crude so much cheaper, the refiners would not operate their cracking plants but would run some straightrun gas oil. The refiners have been reducing their crude runs pretty steadily and may have less rather than more of the U.G.I. gas oil. There are the usual offerings of gas oil which is off in some way from the speci-

(Continued on Page 224)

Soft Refined Market in Eastern Zone

Gasoline Weakened Badly With Other Products Showing No Strength and With Stocks on Increase. Buyers Timid

By A. E. Mockler

New York Bureau, The Oil and Gas Journal, Rooms 1919-21, No. 154 Nassau Street

NEW YORK, Nov. 10.—Refined products markets have softened further during the week and the steady trend toward increasing stocks, in the face of further curtailment of refinery runs, has tended to bring about an easy undertone. This weakness is further intensified by the reduced crude price levels prevailing in many of the more important domestic fields.

Domestic refineries during the week ended November 1 attained the lowest point in operations reached thus far this year, when plants representing 95.6 per cent of the country's capacity operated at a rate of 64 per cent, running to stills an average of 2,281,600 bbls. daily, a reduction of 60,800 bbls. daily from the previous week's figure. Peak refinery operations were attained in the last week of April this year, when refineries ran at 76.7 per cent of capacity.

Stocks of gasoline showed an increase of more than 500,000 bbls. during the closing week in October and with weather conditions indicating a further decrease in consumption, further drastic cuts in refinery operations will be necessary if the industry is to make progress in its efforts to get gasoline holdings at refineries down to the minimum required for actual working stocks.

While gasoline showed outstanding weakness in eastern markets, an easy undertone was discernible in the remainder of the market, with volume still limited to small totals, and buyers in most instances operating on a hand-to-mouth basis, with inventories held down to a minimum and little inclination shown to make forward committments.

Refinery Gasoline

The refinery gasoline market weakened badly during the week and a cut of a half to three-quarters of a cent per gallon in the tank car market is looked for almost daily. U. S. Motor gasoline in tank car lots is posted at 7¾ cents per gallon at refineries, but principal sellers have been booking business at 7 cents this week, and sales at 6¾ to 6⅞ cents a gallon have been by no means infrequent. In view of the fact that the actual market is considerably under the so-called "official" price, it is expected that posted schedules will be lowered to bring the market into some semblance of orderliness.

The unfavorable uneconomic conditions prevailing in many parts of the East is beginning to exert a pronounced influence upon gasoline demand, it is reported, and sales for the closing quarter of the year are expected to run substantially under earlier estimates. Refiners are adjusting their production schedules to take care of this development, and, while plants are now running at the lowest levels of the year thus far, it is expected that further substantial cuts in runs will be witnessed before the close of the year.

Refiners and marketers alike, it is believed, will take steps to further reduce their inventories in order to better their cash position for the year-end, and this does not hold out much promise for market stability during the next few months.

Tank Wagon Gasoline

The spread between tank wagon and retail gasoline prices was lowered in Standard of New Jersey's territory during the past week by a reduction of 1 cent per gallon in the service station price. This and a 1-cent cut in tank wagon and service station prices in Delaware and Pennsylvania were the only general revisions in the East.

With refinery gasoline selling at from three-quarters of a cent to 1 cent a gallon under the levels prevailing when current tank wagon and service station prices in local territory were named, an early cut of 1 cent a gallon by marketers would not come as a surprise to the trade here.

Marketers here were considerably interested in the report of the Bureau of Public Roads this week, estimating 1930 taxable gasoline consumption in the United States at 15,400,000,000 gallons. This compares with a taxable consumption of 14,221,016,279 gallons for 1929. During the first six months of 1930 consumption of taxable gasoline was 6,809,863,076 gallons, against 6,291,710,983 gallons during the first six months of 1929. The increase during the first half of the year, however, will not be carried out during the second half, the report indicates.

The growing tax burden of the industry was indicated by the bureau's report which showed that for the first six months of 1930 an average tax of 3.39 cents per gallon was paid in the 48 states and the District of Columbia, against an average of 3.07 cents a gallon for the first half of 1929 and 3.22 cents a gallon for the full year 1929.

Fuel Oil

Further easiness has developed, in sympathy with the generally weak market for both crude and refined. The posted price for bunker "C" remains at $1.05 per barrel, terminals, in this area. There is considerable shading at some of the South Atlantic ports, however, and Philadelphia has witnessed considerable cutting, business being reported at 90 cents a barrel in the bunker market.

Leading sellers in the local market, however, are still making spot sales at $1.05, terminals, and contract deliveries to shipping companies are also going out at that figure.

Bunker "C" was cut 10 cents per barrel at New Orleans to 90 cents during the week, the reduction having been made effective October 31. It is expected that further reductions will be witnessed in the Gulf market as continued heavy offerings continue to weaken the market undertone.

Standard Oil Co. of New Jersey this week reduced industrial fuel oil one-quarter cent per gallon at 4 cents in bulk at Bayonne.

Diesel Oil

The market remains unchanged at $2 per barrel, bulk, at refinery terminals at East Coast points, but the market tone is not as strong as has been the case during the past several months. While the out look is uncertain, a moderate price cut in the market before the close of the year would not come entirely as a surprise to the trade.

Diesel oil, however, enjoys a better market basis than any of the other fuel oils. Consumption is steadily gaining, both in the marine and domestic fields, and with new motor liners coming into service from month to month and considerable Diesel tonnage under construction, the industry has steadily broadening consumption ahead.

Refiners have not overproduced Diesel oil to the same extent as has been true of other refined products, and fundamentally the market position is therefore much sounder than is true of the other oils. In addition, Diesel engine operators have very definite ideas as to the quality fuel they must have, and because of this there is much less shifting of accounts than is the case with other oils.

Gas Oil

Stocks are fairly heavy, and the market is still under pressure in some quarters. The posted price is 5¼ cents per gallon for 28 plus gas oil in bulk at refinery terminals, but business is being freely done at a quarter to a half cent per gallon under this level.

Eastern refiners have met with considerable competition from California in the filling of utility contracts for gas oil in the East, and because of this outside competition refiners in this area are adopting a general policy of "meeting competition" in order to protect their businesses from outside sellers.

Some of the large eastern companies, however, have moved considerable California gas oil eastward to aid them in making deliveries on some of their accounts.

Furnace Oil

The East has witnessed a real cold spell during the past week, and a sharp increase in gallonage in the furnace oil market has resulted. There is still considerable price cutting in the market, but prices show some signs of stabilizing, and continuance of cold weather would probably prove the salvation of the market.

A record volume of contract business on furnace oils is one the books of refiners and marketers in this area, and, while the current season may not be everything that could be desired, from the price standpoint, no complaints are forthcoming on the gallonage score.

Kerosene

Refinery sales of kerosene have shown considerable increase this week and the season is beginning to hit its real stride. The posted price for water white is 6¾ cents per gallon, refinery, but with U. S. Motor selling at the same levels, an early cut in kerosene is looked for to restore the normal differential. Jobbers have come into the market for kerosene in a rather large way this week, and tank car movement is at the heaviest rate attained thus far in the season.

There has been an active movement of kerosene in the tank wagon market during the week. Quotations are unchanged, but it is expected that prices will be scaled downward by about 1 cent per gallon shortly in the event that the refinery market shows the expected decline.

Lubs

Volume continued on a restricted scale in the cylinder oil market during the week, and the market remained in unsettled position. Spot 650 steam refined is quoted a half cent higher at 23½ cents per gallon, with 630 Pennsylvania flash held at 30 cents per gallon, against 29 cents previously. The market for 600 Pennsylvania flash, however, is softer, with sellers quoting 24 cents per gallon, against 25 cents previously. Other grades are quiet and unchanged.

Demand for red and pale oils was along routine lines throughout the week, with prices remaining unchanged.

Paraffin Wax

An easy undertone featured the market, but no further price declines materialized during the week. Domestic business was limited to small lots, and export demand was also rather slack.

Refinery stocks of wax are still fairly heavy, and buyers are shopping the market thoroughly when coming in with inquiries in an effort to bring to light off-priced offerings.

Export Market

Two cargoes for shipment to France were reported closed at the Gulf this week at posted prices. The cargoes each comprised approximately 800 tons of prime white kerosene, 800 tons of water white kerosene, 800 tons of Navy gasoline and 6,500 tons of 64-66 naphtha, 10 per cent more or less, and were for November-December loading.

Considerable interest was shown by the trade in reports of a pending cut in posted prices for gasoline and kerosene at the Gulf. The reduction, according to rumors in the market here, will be a half cent per gallon in each instance.

Independent refiners are offering in the Gulf export market at a half cent under posted prices for kerosene and Navy gasoline, and three-quarters of a cent per gallon under the posted price of 8 cents for 64-66.

A number of European inquiries, which had been expected this week, are being withheld pending some definite decision as to posted prices at the Gulf, according to cables received by export operators here, and the outlook favors a quiet market until further developments along the price line are forthcoming. The two cargoes actually closed this week were reported taken by the American parent company of French marketing companies.

There were no developments of interest in the Mexican or South American situation during the week, although Venezuelan crude prices were reported readjusted in private sales contracts in line with the lower quotations for competitive grades recently named in this country.

California Oil Receipts

Receipts of California crude and refined petroleum at Atlantic and Gulf Coast ports for the week ended November 1 totaled 126,000 bbls., a daily average of 18,000 bbls., compared with 657,000 bbls., a daily average of 93,857 bbls. for the previous week. Details follow:

	Bbls. of 42 gals.
At Atlantic Coast ports—	
New York	74,000
Philadelphia	52,000
Total	126,000
Daily average	18,000
At Gulf Coast ports—	
All ports	None
At Atlantic and Gulf Coast ports—	
Total	126,000
Daily average	18,000

Distribution of total California oil receipts is as follows:

Gasoline	81,000
Kerosene	45,000

With eastern gasoline stocks accumulating, there has been less interest shown in offerings of Pacific Coast motor fuels in the open market, and considerable price shading is necessary to attract business under present conditions, it is reported here. California kerosene and gas oil, however, is meeting with a seasonably active call in the eastern area, and a fair movement eastward is looked for during the next few months.

Shipments of California refined products eastward for the week (with ownership of tanker moving the oil where such owner of record is an oil company) follow:

To New York—80,500 bbls. of gasoline on the Dilworth; 43,300 bbls. of gas oil and 54,000 bbls. of gasoline on the Standard Arrow (Standard Transportation Co.-S.O.N.Y.).

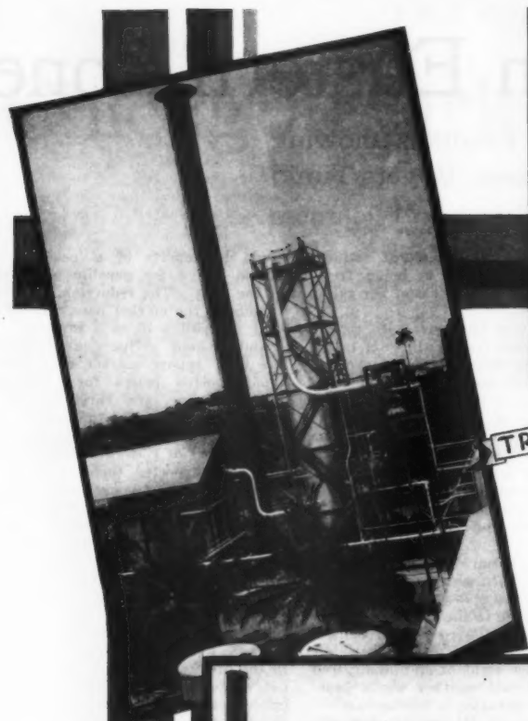
To Philadelphia—114,500 bbls. of gasoline on the Western Sun (Sun Oil Co.).

Petroleum Exports

The local export trade continued rather uneventful and continued light movement of refined products into export channels was recorded during the week ended November 1. With spot demand of relatively limited volume, indications pointed to continued quiet in export shipments locally for the immediate future. Export buyers are holding stocks down to a minimum, and no departure from this hand-to-mouth policy of operations is looked for while present disturbed conditions within the industry continue unchecked.

The following table shows principal ex-

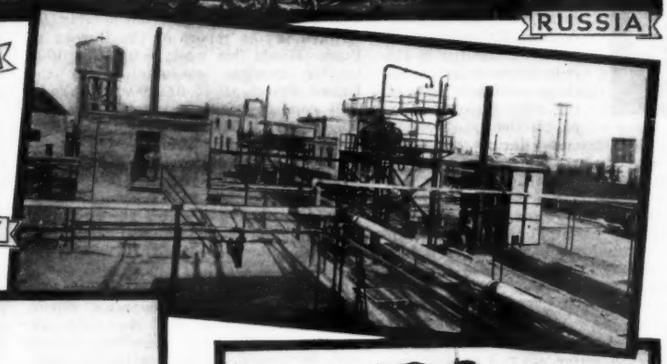
(Continued on Page 224)

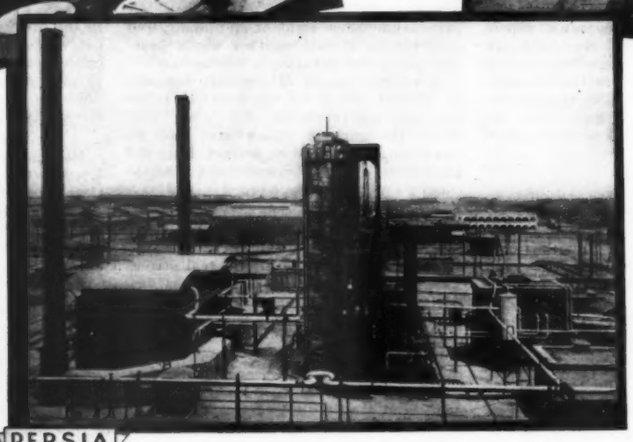


TRINIDAD

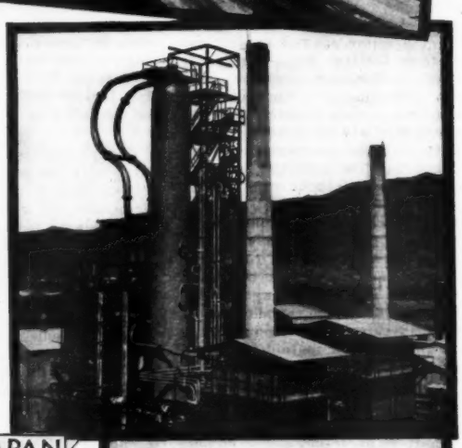
RUSSIA

ITALY

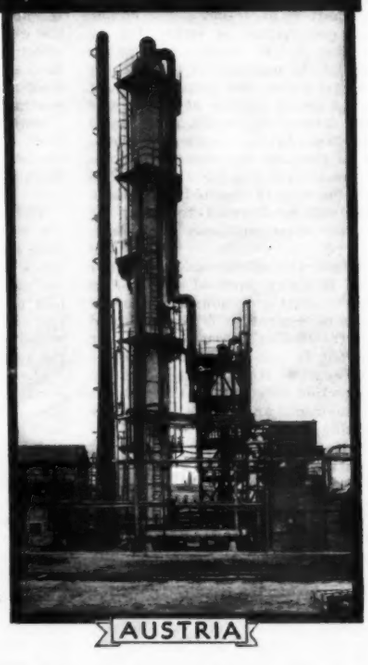




PERSIA



JAPAN



AUSTRIA

Refinery Engineering

The installation of Foster Wheeler refining equipment throughout the world is the best evidence of its ability to fractionate crudes in various parts of the world, recovering products to meet exacting specifications.

The accompanying illustrations represent a few Foster Wheeler foreign installations.

FOSTER WHEELER CORPORATION
165 Broadway, New York, N. Y.
Branches in Principal Oil Centers

Foreign Associates: Foster Wheeler Limited, London, England.
Foster Wheeler Limited, Toronto-Montreal, Canada.
Societe Anonyme Foster Wheeler, Paris, France.

FOSTER WHEELER

Manufacture of Natural Gasoline

Much Care Required In Natural Gasoline Boiler Inspections

By B. F. Spigener
Columbian Gasoline Corp.

As a part of the routine of the periodical inspection of boilers in any natural gasoline plant, the engineer and the other boiler operators are notified when the inspection is to be made, so that they can arrange to have the boilers in suitable condition.

Before a boiler can be inspected the fire must be drawn, the water removed, and the boiler and setting allowed to cool off.

The manhole covers and handhole plates should be removed. The inspector then can make an internal inspection while the inside of the boiler is being prepared. The boiler must be thoroughly aired and all valves leading to the boiler must be closed before anyone enters it. All boiler valves should be watched to see that no one tampers with them when anyone is in the boiler.

The interior of the boiler should be cleaned by washing out all loose scale and mud. This is necessary in order that the plates, rivets, seams and braces can be inspected for corrosion and breaks. The tubes of fire tube boilers should be cleaned with a wire brush.

Boiler Inspector's Needs

The boiler inspector should be provided with a good light, preferably an electric light, a good scraper having a thin blade, chalk for marking defective parts, a light hammer, and a notebook for recording the locations of parts found to be damaged and for any other information pertaining to construction, material and design. The hammer is used for sounding the plates, rivets, staybolts and braces, and the metal scraper is used as a feeler for locating cracks around joints and rivets and between the tubes.

A traveling inspector carries a regular outfit of all the tools and instruments needed by him for making a complete test.

The hammer test or sounding for hidden defects in plates, stays, braces and other parts, is made by tapping the suspected parts with a light hammer and judging the existence and extent of defects from the sound produced by the hammer blow. If the examination discloses wear and tear, a series of calculations often is required to find the safe pressure that may be allowed on the worn parts.

Staybolts of either the flexible or the solid screwed type are tested by the use of a hand hammer of suitable form, size and weight. The shape of hammers may vary, but the weight is from 1 to 1½ pounds. The handle is of hickory and is tapered toward the head so as to form a neck from five-sixteenths to one-half inch in diameter, the narrow neck giving spring to the handle, so that when a solid staybolt is struck, the rebound of the hammer is clearly felt.

Seams Examined Inch by Inch

The seams are gone over inch by inch; the rivet heads and the calking edges of the plates are carefully scrutinized for evidence of leaks; and possible cracks are looked for between the rivet heads, especially in the girth seams and on the underside of the boiler. The rivets are tested to locate loose rivets, which may be done by striking the rivet heads with the testing hammer. A tight rivet gives a clear metallic sound and the hammer rebounds from the blow; but on striking a loose rivet, the hammer does not react from the blow; and the sound given out is dull and dead. The plates are examined for corrosion, bulges, blisters and cracks. If the boiler has a mud drum

(Continued on Page 227)

REVISED SPECIFICATIONS SUBMITTED FOR ANTIKNOCK AVIATION GASOLINE

A tentative revision of the Government's specifications on fighting antiknock grade of aviation gasoline has been submitted to the industry for consideration. The new specifications require the gasoline to have a Reid vapor pressure at 100° F. not to exceed 6.5 pounds, and this will be of interest to natural gasoline manufacturers. The volume of aviation gasoline consumed still remains a small factor as far as the total consumption of gasoline as a motor fuel is concerned but the specifications adopted will serve as the basis for the manufacture and marketing of aviation gasoline in the future, when the consumption is likely to be many times that at present.

In a similar manner, the consumption of the fighting grade of aviation gasoline is of comparatively little importance with respect to total volume. However, the more recent trend in motor fuel specifications has been to adopt rather stringent requirements and the effect has been to place greater limitations on the volume possible to manufacture at current price levels. Then later these special requirements are made applicable on aviation fuels in general.

The natural gasoline industry has been co-operating with the Government aviation fuel experts at the Dayton flying field and expect to continue to carry on exhaustive tests in the future for the purpose of determining the limiting factors, more particularly, the highest allowable safe Reid vapor pressure, the best distillation range, the lowest antiknock rating needed and the effect of sulphur on the motors.

Work Carried on by Companies

This work is being carried on by individual companies, who are members of the association, pooling their test results. These results are to be summarized by Dr. G. G. Brown, who is well known for his previous work in the study of natural gasoline as a motor fuel. As a result of these tests, the association feels it will be fully equipped to aid in suggesting other revisions in aviation fuel specifications as they are brought up for discussion.

A summary of the Government's tentative revision of the specifications on fighting grade aviation gasoline follows:

1. Only gasoline consisting of a refined fraction of crude petroleum and (or) natural gas will be considered. Tetraethyl lead and (or) aromatic hydrocarbons may be added as specified herein.

2. The gasoline shall be free from water and suspended matter.

Detail Requirements

1. Antiknock value: The antiknock value shall be equal to that of a mixture of 87 parts of 2-2-4 tri-methyl pentane and 13 parts of normal heptane (the proportions being by weight).

2. Tetraethyl lead may be added in the form of Ethyl fluid in concentration not exceeding 6 milliliters of tetraethyl lead per United States gallon.

3. Benzol and similar aromatic hydrocarbons may be added in such quantity that the blend meets all requirements for the finished fuel and the freezing point specified, in particular.

4. The color shall be purple and of shade and intensity equal to sample supplied.

5. Corrosion, Method 530.1: One hundred milliliters of the gasoline evaporated in a polished copper dish shall cause no gray or black corrosion.

6. Gum: The gasoline shall also be subject to an accelerated aging test at 100° C. (212° F.) with oxygen at approximately 100 pounds pressure for two hours, followed by evaporation of 100 millimeters of oxidized sample (plus the addition of gum solvent in accordance with Method 530.1 except that a glass dish shall be used. The amount of residue shall not exceed 15 milligrams.

7. Sulphur, Method 520.11: Sulphur shall not be over 0.10 per cent.

8. Distillate range, Method 100.13: The temperature limits are as follows:

When the thermometer reads 75° C. (167° F.) not less than 10 per cent shall be evaporated.

When 50 per cent has been recovered in the receiver, the thermometer shall not read more than 95° C. (203° F.).

When 90 per cent has been recovered in the receiver, the thermometer shall not read more than 125° C. (257° F.).

When 96 per cent has been recovered in the receiver, the thermometer shall not read more than 150° C. (302° F.).

The endpoint shall not be higher than 165° C. (329° F.).

At least 96 per cent shall be recovered as distillate in the receiver from the distillation.

The distillation loss shall not exceed 2 per cent when the residue in the flask is cooled and added to the distillate in the receiver.

The per cent evaporated shall be found by adding the distillation loss to the amount collected in the receiver at each specification temperature.

9. Reid vapor pressure: The Reid vapor pressure at 37.8° C. (100° F.) shall not exceed 6.5 pounds per square inch. The pressure shall be determined as specified in A.S.T.M. tentative method of test for vapor pressure of natural gasoline (Reid method) A.S.T.M. designation D-323-30 T issued 1930.

10. Freezing point: The freezing point as indicated by the initial formation of solid rather than by the cloud point shall not be higher than minus 60° C. (minus 76° F.).

Method of Inspection and Tests

1. The gasoline shall be subject to inspection by the procuring agency at such place or places as specified in the contract or purchase order. When inspection is conducted at place of manufacture, the inspector shall be furnished all necessary facilities to determine compliance with this specification.

2. Acceptance or approval of material in course of manufacture shall in no case be construed as a guaranty of the acceptance of the finished product.

3. Sample: A sample of not less than 3 gallons shall be forwarded to the place of inspection for tests. The shipment will not be acceptable until this has been inspected and tested.

4. All tests not described herein shall be made in accordance with the latest issue of the Bureau of Mines Technical Paper No. 323, "Methods for Testing Lubricants and Liquid Fuels."

5. Method of determining antiknock value: The antiknock value of the sample shall be determined by comparison with the secondary standard in an Ethyl Gasoline Corp. Series 30 knock test engine, operated under the following conditions, with material and equipment specified herein:

a. Revolutions per minute: The r.p.m. shall be 600.

b. Compression ratio: The compression ration shall be 7.25-7.75 to 1.

c. Temperature: The temperature of cooling liquid shall be 149° C. (300° F.) plus or minus 5° C. (9° F.).

d. Spark timing: The spark timing shall be 14° to 16° before top center.

e. Valve timing: The valve timing shall be as follows with .002 inch clearance between the rockers and the tips of the valve stem:

1. Intake opens 20° plus or minus 10° after top dead center.

2. Intake closes 10° plus or minus 10° after bottom dead center.

3. Exhaust opens 55° plus or minus 10° before bottom dead center.

4. Exhaust closes 10° plus or minus 10° after top dead center.

f. Oil: The lubricating oil used during the tests shall conform to Grade No. 120, Specification No. 3,556.

g. Amount of oil: The level of the oil above the feet of the crankcase shall not exceed 1½ inches. (This requires 800 ml. of oil in a dry crankcase.)

h. Oil smoke: There shall be no evidence of oil smoke in the exhaust while tests are being conducted.

i. Carburetor: The carburetor shall be of the dual float chamber type which will permit a rapid switch from the secondary standard to the sample under test and vice versa.

j. Spark plugs: The spark plug used shall be either a BG-1XB or BG Hornet 4B type or A.C. types 25, 35 or 45.

k. Mixture strength: The mixture strength required to produce a maximum tendency to knock shall be determined for the secondary standard and the sample in any comparative test by raising and lowering boat float chambers in regular increments. The maximum knock mixture strength shall be used in all tests.

l. Degree of detonation: The throttle shall be set on the secondary standard to produce a sharp knock, but set so that firing ceases instantly upon cutting the ignition switch, thus indicating both lack of preignition and afterfiring. A sharp cut on the ignition switch shall also be obtained on the sample undergoing test.

m. Measurement of detonation: Detonation should be measured by means of the standard bouncing pin furnished with the engine.

n. Test to Determine Antiknock Value—At least three alternate comparisons of the sample with the secondary standard shall be made. The sample on an average of three comparisons shall not be inferior to the secondary standard.

o. Secondary standard sample: Samples of the secondary standard equaling the primary standard of 87 parts of 2-2-4 tri-methyl pentane and 13 parts of normal heptance will be supplied upon request in 1-gallon lots and will be shipped express collect.

6. Accelerated aging test with oxygen for gum:

a. An 8-ounce sample bottle of the finished fuel to be tested, covered with a loose glass cover over the neck to prevent the ingress of dirt, etc., is inclosed in a bomb with the bomb and contents at room temperature.

b. The finished fuel is the base gasoline to which tetraethyl lead or aromatics have been added in amounts not to exceed that permitted by this specification.

c. The bombs shall be twice filled

(Continued on Page 227)

TURNER VALLEY PLANT

CHATHAM, Ontario, Nov. 10.—It is reported that unnamed interests are contracting with independent oil operators in the Turner Valley Field for their waste gas production, to be handled in a gasoline absorption plant. Contracts have been signed with several companies, it is stated, while negotiations are in progress with others. The waste gas is at present burned in flares to get rid of it. A plant at a reported cost of $500,000 is in contemplation, which will extract the gasoline left after the gas passes through the separators. The residual gas will be available for marketing to Regina and other cities should a franchise be granted.

Brief Items for Petroleum Refiners

Export Organization Gives Up Its Nominal Control Over Prices

NEW YORK, Nov. 10.—The Export Petroleum Association, Inc., has relinquished its nominal control over prices for American refined petroleum exports, through cancellation of its price schedules, and eventual dissolution of the export body is looked for. An official announcement issued by the association here on November 7 stated: "The Export Petroleum Association, Inc., has today cancelled all of its export price schedules."

While Gilbert H. Montague, vice president, general counsel, and official "spokesman" for the association, declined to amplify the official statement, it was denied at the association headquarters that the organization had disbanded or that resignations had been received from any of its members. In oil trade circles, however, it was reported in numerous quarters that early dissolution of the Export association was in sight, its members feeling that there was nothing to be gained by its continuance since it had failed to perform the functions for which it was organized.

The Export association is now a little less than two years old, and save for a brief time following the organization of the group its schedule of posted prices for gasoline and kerosene has failed to "make the market" at the Gulf. The association was formed originally, under the provisions of the Webb-Pomerene Act, to stabilize the American export petroleum industry through the fixing of uniform prices for the sale of American gasoline and kerosene to foreign consumers.

Fifteen Companies Formed Group

Fifteen of the largest oil companies in the United States originally formed the roster of the group, one additional member having since been added. It was announced that the charter members of the association, made up of the largest integrated companies in the country, were to form the backbone of an association to take in all of the petroleum industry of the United States. The export group, it was said, would be representative of the entire industry. While reports were current at various times of the imminence of inclusion of smaller interests, the organization apparently never progressed to the point where it was felt that this

(Continued on Page 224)

REFINERY OFFICIALS CONFER

BEAUMONT, Tex., Nov. 10.—A three-day conference of refinery officials of the Standard Oil Co. of New York, and subsidiaries, Magnolia Petroleum Co., the General Petroleum Co. of California and the White Eagle Oil Corp., was held in Beaumont November 6, 7 and 8. Those attending the conference were W. F. Burt, of New York, manager of the refining department of the Standard Oil Co. of New York; R. R. Irwin, president of the White Eagle; Dr. J. B. Rather, F. S. Shepherd and Mr. Moeller of New York; S. J. Dickey, R. C Wheeler, Fred Isaacs and F. T. Olsen, of Los Angeles; E. C. Marshall and G. P. Dunham of Kansas City; C. E. Durkee of Augusta, Kan.; J. W. Glass, of Casper, Wyo.; W. C. Ralston, of Corsicana, Tex.; J. T. Dickens, of Luling, Tex.; John Ritter and Eugene Ritter, of Fort Worth, Tex.; Ralph H. Kinsloe, Fred M. Lege, B. H. Stephens, D A. Little, Fred Bedford and R. D. Hanley, Dallas, Tex. The visitors were guests of E. E. Plumly, vice president and general manager, and other officials of Magnolia Petroleum Co. in Beaumont.

STANDARD OF CALIFORNIA RESTORES FIRST REFINERY ERECTED IN STATE

LOS ANGELES, Calif., Nov. 10.—In a canyon, one-half mile southwest of Newhall, the California oil industry dedicated Thursday, November 6, a memorial to the first refinery built in the State and on the West Coast.

The refinery site and what is left of the old plant, idle for many years, have been given as a permanent memorial by the Standard Oil Co. of California which was in charge of the ceremonies. A bronze tablet was unveiled by Mrs. Rosamond B. Watson, gradddaughter of D. G. Scofield, one of the pioneers of the California refining industry. On the tablet is this inscription:

"California's first oil refinery operated on a commercial scale erected 1876, restored by the Standard Oil Co. of California in 1930 as a memorial to D. G. Scofield and his pioneer associates of the California Star Oil Works Co., a predecessor of the Standard Oil Co. of California. In 1875-76, Mr. Scofield and his associates obtained California's first commercial production of crude petroleum in the Pico Canyon, six miles northwest of this point and built this refinery for the manufacture of petroleum products."

L. B. Little, superintendent of production for the Standard Oil Co. of California, presided as chairman, at the ceremonies which were attended by 300 men and women and a few of whom were connected with the early oil operations in the State. Among the old-timers who spoke were Walton Young, Clay Reynolds and J. W. Saunders, all residents of California. H. C. Hanna, superintendent of the El Segundo, Calif., refinery of the Standard, also spoke.

The refinery as it looked originally.

The refinery was built shortly after the first well was completed in Pico Canyon in 1875. The first well had an initial production of 100 bbls. daily and other wells were quickly drilled. The Star company decided to build a refinery and this was connected to the field with a 2-inch cast iron line. The plant turned out from 150 to 300 bbls. of refined products for several years. The principal product was kerosene. Shortly afterwards the company was taken over by the Standard Oil Co. of California and D. G. Scofield became its first president.

RUMOR NAMES SINCLAIR AND McCOLL-FRONTENAC

NEW YORK, Nov. 8.—The Sinclair Consolidated Oil Corp. is reported negotiating for the McColl-Frontenac Oil Co., Ltd., as the initial step in its Canadian expansion program. This report follows the recent rumor, subsequently denied by Sinclair officials, that the company was planning the expenditure of $30,000,000 in refinery construction in Canada.

McColl-Frontenac Oil Co., Ltd., is a leading factor in the Canadian oil industry. Incorporated December 21, 1927, the company refines and distributes gasoline and other petroleum products throughout Canada, and owns Canadian rights for the manufacture and distribution of "Cyclo" gasoline. The company, as organized three years ago, represented a consolidation of McColl Brothers, Ltd., and the Frontenac Oil Refineries, Ltd.

The company has refineries in Montreal East and Toronto, with aggregate capacity of 10,000 bbls. of crude daily. The company operates five tank steamers with combined carrying capacity of 229,000 bbls. A storage plant is owned in Buffalo, where crude received by pipe line from the United States is trans-shipped to the company's refineries. The company operates tank cars and an extensive retail service station chain.

McColl-Frontenac has enlarged and modernized its refineries in the last year to increase its gasoline output. The refineries operate at capacity throughout the winter turning out motor fuel for storage for summer requirements.

ALBERTA CONSUMPTION RISES

CHATHAM, Ontario, Nov. 10.—Official figures show that gasoline consumption in Alberta up to September 30, 1930, amounted to approximately 37,000,000 gallons, compared with 34,700,000 gallons in the same period of 1929. The year is expected to show a substantial increase, with a revenue to the provincial government from the 5-cent gasoline tax of approximately $1,000,000.

REGAL ENLARGES REFINERY

CHATHAM, Ontario, Nov. 10.—The Regal Oil & Refining Co. will erect the first unit of a treating plant in connection with its refinery in the Manchester subdivision of Calgary. The plant will cost $50,000 and will remove the sulphur odor from the Turner Valley crude and naphtha handled in the refinery.

Lists Units Being Installed at Many Scattered Points

CHICAGO, Nov. 8.—Two more refiners of Pennsylvania grade crude oil have recently signed contracts for the Dubbs cracking process. These are the Emlenton Refining Co. at Emlenton, Pa., and the Ohio Valley Refining Co. at St. Marys, W. Va. Each of these units is of 750 bbls. daily capacity. Construction work has already started.

While these units are expected primarily to run on Pennsylvania kerosene and gas oil, they are capable of operating on any kind of oil or by-product as well. They would be suitable, in fact, to crack successfully distillates or residues from western crude or crude from any source that might in future become available, even to heavy crude itself.

The ordering of these two units follows close upon the signing of a contract by the Pennzoil Co. for a Dubbs cracking unit of 2,500 bbls. capacity for its refining at Oil City. This Pennzoil unit is to be operated co-operatively, handling stocks from the plants of the Continental Refining Co., Oil City, Pa., the Empire Oil Works at Reno, and the Independent Refining Co. at Oil City, as well as those from the Pennzoil refinery. The new Pennzoil unit, upon which work is well under way, is being built by the Arthur G. McKee Co. of Cleveland, and is the third Dubbs cracking unit to be installed at the Pennzoil plant.

The Emlenton and Ohio Valley units are being built by Universal Oil Products Co. direct.

These three new units will practically double the Dubbs cracking capacity in refineries operating on Pennsylvania grade crude oil, bringing it to about 10,000 bbls. a day of charging stock. Although the first Dubbs unit built in Pennsylvania was put in operation in 1923, the growing demand for gasoline of high antiknock value has lately emphasized in the minds of Pennsylvania refiners the necessity for more cracking in order to make gasoline more suitable for present-day markets.

The Dubbs cracking process, operating at moderate temperatures and pressures, makes a product from Pennsylvania stocks of such antiknock value that when blended with straightrun Pennsylvania gasoline it brings that fuel well within market requirements.

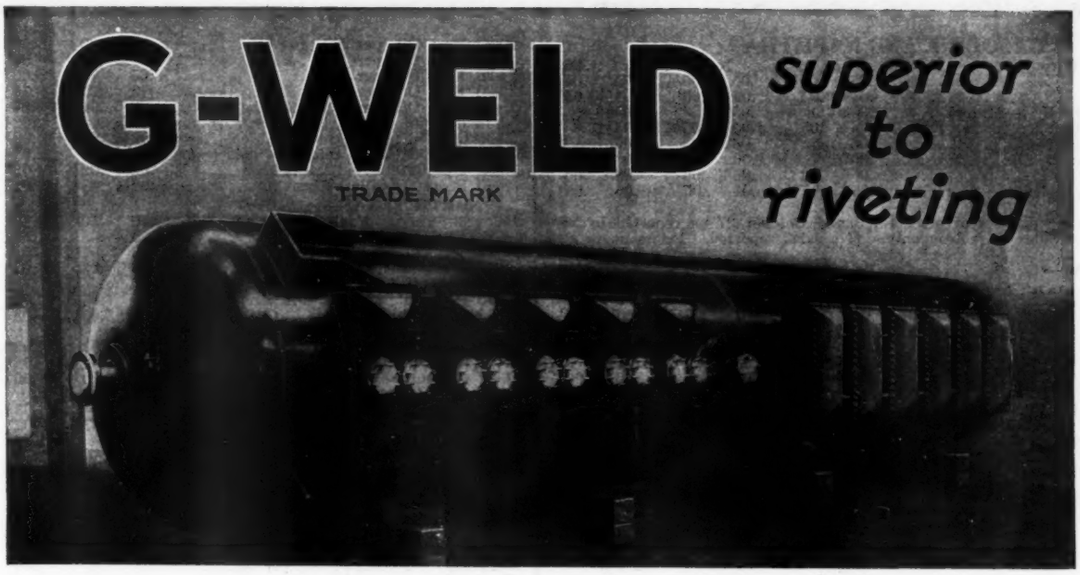
The earliest Dubbs cracking unit in Pennsylvania, just referred to, was installed at the plant of the Freedom Oil Works Co., Freedom, Pa. Two units were installed at the plant of the Kendall Refining Co., Bradford, Pa., in 1924, and Pennzoil's first two were started up in 1927.

The growing interest of foreign nations in establishing refining industries of their own, even when they have no crude oil

(Continued on Page 224)

WHITING FIRE LOSS SMALL

CHICAGO, Nov. 10.—Following misleading accounts of the recent fire at the Whiting refinery of the Standard Oil Co. (Indiana) the company has issued a statement in which it says complete repairs can be made for $10,000 at the outside. A pipe burst at the discharge end of a pump which was circulating hot oil from a bubble tower back into a pressure still. The oil ignited immediately on coming into contact with the air and burned in a spectacular manner. Men working 50 feet away when the fire started got away without injury. The feed line to the unit was immediately closed and the fire confined to consumption of the oil that poured out of the line, not more than 300 bbls



THE new Griscom-Russell welding process provides a dense, thorough bond, free from cracks, porous spots, slag or other flaws. The innumerable laboratory and service tests which have been made on G-Welds consistently show them to be stronger than the adjacent plate, remarkably ductile, and as resistant to corrosion as the plate itself.

The G-Weld is used by The Griscom-Russell Company to assure permanent tightness of pressure vessels without danger of overheating and damage to the plate or development of internal stresses during the welding process. It is applicable to all sizes and thicknesses of plate and for all shapes of vessels, and has received the unqualified approval of insurance companies.

The trade mark G-WELD is always stamped on welds made by this process.

HEAT EXCHANGERS
CONDENSERS
Sub-cooling—Partial—Reflux
COOLERS
Liquid—Gas—Jacket Water
OIL HEATERS
LEVEL CONTROLLERS

THE GRISCOM-RUSSELL COMPANY
285 Madison Avenue, New York
Branch Offices in 27 Cities

Griscom-Russell

Heat Transfer Apparatus

REFINERY AND CRUDE PRICES

Quotations on refined products are for interstate or export movement unless otherwise noted.

GASOLINE AND NAPHTHA

OKLAHOMA (Group 3)—	Nov. 11		Nov. 4		Oct. 28	
50-52 450 endpoint	.05	.05¼	.05	.05¼	.05	.05¼
56-58 450 endpoint	.04¾	.05	.04¾	.05	.04¾	.05
*58-60 437 endpoint (U. S. Motor)	.0530		.0563		.0560	
*60-62 437 endpoint	†.05¼	.05½	†.05¼	.05½	†.05¼	.05½
*60-62 400 endpoint	.06		.0625		.0631	
*64-66 375 endpoint	.0675		†.06		.0688	
68-70 360 endpoint	.05¾	.06	.05¾	.06	.05¾	.06
64-66 437 endpoint (blend)	.05	.05¼	.05	.05¼	.05	.05½

*Weighted average prices November 10, 3 and October 27 as reported by representative refiners. Sales to jobbers only. †No sales reported. Prices show general market.

NORTH TEXAS—						
50-52 450 endpoint	.05	.05¼	.05	.05¼	.05	.05¼
58-60 450 endpoint	.04¾	.05	.04¾	.05	.05	.05¼
58-60 437 endpoint (U. S. Motor)	.04⅞	.05¼	.04⅞	.05¼	.05	.05¼
60-62 400 endpoint	.05¼	.05½	.05¼	.05½	.05¼	.05½
64-66 390 endpoint	.05⅜	.05¾	.05⅜	.05¾	.05½	
64-66 375 endpoint	.05½	.05¾	.05½	.05¾	.05¾	
68-70 360 endpoint	.06		.06		.06	.06¼
64-66 437 endpoint (blend)	.05	.05¼	.05	.05¼	.05	.05¼
*NORTH LOUISIANA—						
58-60 437 endpoint (U. S. Motor)	.06¼	.06½	.06¼	.06½	.06¼	.06½
*ARKANSAS—						
58-60 437 endpoint (U. S. Motor)	.06¼	.06½	.06¼	.06½	.06¼	.06½
PENNSYLVANIA—						
52-54 Naphtha	.06¾		.06¾		.06¾	
54-56 Naphtha	.06¾		.06¾		.06¾	
58-60 Gasoline	.06¾		.06¾		06¾	
60 Gasoline	.06¾	.07	.06¾	.07	06¾	.07
62 Gasoline	.07		.07		07	
64 Gasoline	.07½		.07½		.07½	
68-70 350 endpoint gasoline	.08½		.08½		.08½	
CALIFORNIA—						
†58-60 437 endpoint (U. S. Motor) domestic	.08	.11	.08	.11	.08½	.11
†60-62 400 endpoint domestic gasoline	.09½	.11½	.09½	.11½	10	.12
CHICAGO DISTRICT (Based on Group 3)—						
50-52 450 endpoint (Naphtha)	.04¾		.05		.05¼	
56-58 450 endpoint	.04⅝	.05	.04¾	.05	.05	
58-60 437 endpoint (U. S. Motor)	.04¾	.05¼	.04¾	.05¼	.04¾	.05
60-62 400 endpoint	.05	.05½	.05	.05¼	.05	.05¼
64-66 375 endpoint	.05½	.06	.05¾	.06	.05¾	.06
64-66 437 endpoint (blend)	.04¾	.05¼	.04¾	.05¼	.05¼	.05¾
68-70 360 endpoint	.06	.06¼	.06¼	.06½	06	.06¼
GULF COAST (Export)—						
58-60 U. S. Motor	.06	.06½	.07		.07	
60-62 400 endpoint	.06¼	.07	.07½		.07½	
61-63 390 endpoint	.06½	.07¼	.07¾		.07¾	
64-66 375 endpoint	.06⅞	.07½	.08		.08	

*Louisiana, Arkansas, Mississippi and East Texas delivery. †For local consumption.

NATURAL GASOLINE

OKLAHOMA (Group 3)—	Nov. 11		Nov. 4		Oct. 28	
Grade A, 72-79.9, 375 e.p., rec. 90%	.04½	.04¾	.04½	.04⅝	.04¾	
Grade AA, 80-87.9, 375 e.p., rec. 90%	.04½		.04½		.04¾	
Grade B, 76-83.9, 375 e.p., rec. 85%	.04½		.04½		.04¾	
Grade BB, 84-92, 375 e.p., rec. 85%	.04½		.04½		.04¾	
Grade C, 80-92, 375 e.p., rec. 78%	.04½		.04½		.04¾	
NORTH TEXAS—						
Grade A, 72-79.9, 375 e.p., rec. 90%	.04½		.04½		.04¾	
Grade AA, 80-87.9, 375 e.p., rec. 90%	.04½		.04½		.04¾	
Grade B, 76-83.9, 375 e.p., rec. 85%	.04½		.04½		.04¾	
Grade BB, 84-92, 375 e.p., rec. 85%	.04½		.04½		.04¾	
Grade C, 80-92, 375 e.p., rec. 78%	.04½		.04½		.04¾	
NORTH LOUISIANA—						
Grade AA, 80-87, 375 e.p., rec. 90%	.04½	.04¾	.04½	.04¾	.04¾	.05
Grade BB, 84-92, 375 e.p., rec. 85%	.04½		.04½		.04¾	
Grade C, 80-92, 375 e.p., rec. 78%	.04½		.04½		.04¾	
CALIFORNIA—						
75-78, 375-390 endpoint	.07	.09	.07	.09	.07	.09
CHICAGO DISTRICT (Based on Group 3)—						
Grade A, 72-79.9, 375 e.p., rec. 90%	.04½		.04½		.04¾	
Grade AA, 80-87.9, 375 e.p., rec. 90%	.04½		.04½		.04¾	
Grade BB, 84-92, 375 e.p., rec. 85%	.04½		.04½		.04¾	

*Louisiana, Arkansas, Mississippi and East Texas delivery.

BURNING OIL

OKLAHOMA (Group 3)—	Nov. 11		Nov. 4		Oct. 28	
41-43 water white kerosene	.03½	.03¾	.03½	.03¾	.03½	.03¾
42-44 water white kerosene	.03¼	.03¾	.03¼	.03¾	.03¼	.03⅞
NORTH TEXAS—						
41-43 water white kerosene	.03	.03¼	.03	.03¼	.03	.03¼
40-41 water white kerosene	.02⅞	.03	.02⅞	.03	.02⅞	.03
*NORTH LOUISIANA—						
41-43 water white kerosene	.04	.04¼	.04	.04¼	.04	.04¼
*ARKANSAS—						
41-43 water white kerosene	.04	.04¼	.04	.04¼	.04	.04¼
PENNSYLVANIA—						
43 Kerosene prime white	.04¾		.40¾		.04¾	
45 Kerosene water white	.04⅞	.05⅛	.04⅞	.05⅛	.05	.05¼
46 Kerosene water white	.05	.05¼	.05	.05¼	.05	.05¼
CALIFORNIA—						
38-40 water white Kero. (high burning test)	.05	.06	.05	.06	.05	.06
CHICAGO DISTRICT (Based on Group 3)—						
41-43 water white kerosene	.03	.03¼	.03	.03¼	.03	.03¼
42-44 water white kerosene	.03¼	.03½	.03¼	.03½	.03¼	.03½
GULF COAST (Export)—						
41-43 prime white	.04½	.04¾	.05		.05	
41-43 water white	.05½	.05¾	.06		.06	

*Louisiana, Arkansas, Mississippi and East Texas delivery.

FUEL OIL

OKLAHOMA (Group 3)—	Nov. 11		Nov. 4		Oct. 28	
Below 18 gravity Fuel Oil, per bbl.	.45	.50	.45	.50	.43	.50
18-22 Fuel Oil, per bbl.	.50	.55	.52½	.57½	.52½	.57½
20-22 Fuel Oil, per bbl.	.55	.60	.55	.60	.55	.60
22-26 Fuel Oil, per bbl.	.60	.65	.60	.65	.60	.65
24-26 Fuel Oil, per bbl.	.65	.70	.65	.70	.65	.70
26-30 Fuel Oil, per bbl.	.70	.75	.70	.75	.70	.75
28-30 Fuel Oil, per bbl.	.80	.90	.80	.90	.80	.90
32-36 Gas Oil (industrial)	.02⅛	.02¼	.02⅛	.02¼	.02⅛	.02¼
32-36 Gas Oil (straw color, high cold test)	.02¼	.02½	.02¼	.02½	.02¼	.02½
32-36 Gas Oil (straw color, low cold test)	.02⅝	.02⅞	.02⅝	.02⅞	.02⅝	.02⅞
36-38 Distillate	.02⅜	.02⅞	.02⅜	.02⅞	.02⅜	.02⅞
38-40 Straw Distillate	.02¾	.03¼	.02¾	.03¼	.02¾	.03¼
NORTH TEXAS—						
Below 20 gravity Fuel Oil, per bbl.	.40	.50	.40	.50	.40	.50
24-26 Fuel Oil, per bbl.	.55	.65	.55	.65	.55	.65
32-36 Gas Oil (industrial)	.02	.02¼	.02	.02¼	.02	.02¼
38-40 Straw Distillate	.02¾	.03	.02¾	.03	.02¾	.03
*NORTH LOUISIANA—						
18-20 Fuel Oil, per bbl.	.75	.85	.75	.85	.80	.85
30-32 Gas Oil	.03	.03¼	.03	.03¼	.02⅞	
*ARKANSAS—						
33-36 Distillate	.02¾	.03	.02¾	.03	.02¾	.03
30-32 Gas Oil	.02¾	.02⅞	.02¾	.02⅞	.02¾	.02⅞
16-22 Refinery Fuel Oil, per bbl.	.65	.70	.65	.70	.65	.70
GULF COAST (South Texas)—						
Gas Oil	.03¾		.03¾		.03¾	
Bunker C Fuel (cargo lots), per bbl.	.65	.67½	.62½	.67½	.62½	.67½
Bunker C Fuel (small lots)	1.00		1.00		1.00	
PENNSYLVANIA—						
30-34 Fuel Oil	.03¾		.03¾		.03¾	
36-40 Fuel Oil	.03¼		.03⅞		.03⅞	.04
CALIFORNIA—						
33-36 Distillate	.02	.02½	.02	.02½	.02	.02½
26-32 Distillate	.01¾	.02	.01¾	.02	.01¾	.02
15-20 Fuel Oil, Bunker (at tidewater)	.60	.95	.60	.95	.65	.95
15-20 Fuel Oil (cargo lots), per bbl.	.55	.85	.55	.85	.60	.85
27 plus Diesel, per bbl.	.85	1.00	.85	1.00	.85	1.00
CHICAGO DISTRICT (Based on Group 3)—						
18-22 Fuel Oil, per bbl.	.57½	.65	.57½	.65	.57½	.62½
22-26 Fuel Oil, per bbl.	.65	.70	.65	.70	.65	.70
28-30 Fuel Oil, per bbl. (zero)	.90	.95	.90	.95	.90	.95
32-36 Gas Oil (zero)	.02½	.02⅞	.02½	.02⅞	.02½	.02⅞
32-36 Gas Oil (industrial)	.02⅛	.02¼	.02¼	.02⅜	.02¼	.02⅜
38-40 Straw Distillate	.02¾	.03	.02¾	.03	.02¾	.03

*Louisiana, Arkansas, Mississippi and East Texas delivery.

LUBRICATING OIL AND WAX

OKLAHOMA (Group 3)—	Nov. 11		Nov. 4		Oct. 28	
100 vis., 2 color, 20-25 cold test	.06	.06¼	.06	.06¼	.06	.06¼
100 vis., 3 color, 20-25 cold test	.05¾	.06	.05¾	.06	.05¾	.06
150 vis., 3 color, 20-25 cold test	.07		.07		.07	
150 vis., 4 color, 20-25 cold test	.06½		.06½		.06½	
180 vis., 3 color, 23-28 cold test	.08½		.08½		.08½	
180 vis., 4 color, 23-28 cold test	.08		.08		.08	
180 vis., 5 color, 23-28 cold test	.07¼	.07½	.07¼	.07½	.07¼	.07½
200 vis., 3 color, 23-28 cold test	.09¾	.10	.09¾	.10	.09¾	.10
200 vis., 4 color, 23-28 cold test	.09½		.09½		.09½	
200 vis., 5 color, 23-28 cold test	.09		.09		.09	
240 vis., 3 color, 25-30 cold test	.13¼	.13½	.13¼	.13½	.13¼	.13½
240 vis., 4 color, 25-30 cold test	.12¼	.12½	.12¼	.12½	.12¼	.12½
240 vis., 5 color, 25-30 cold test	.11¼	.11½	.11¼	.11½	.11¼	.11½
280 vis., 3 color, 25-30 cold test	.15½		.15½		.15½	
280 vis., 4 color, 25-30 cold test	.14½		.14½		.14½	
280 vis., 5 color, 25-30 cold test	.13½		.13½		.13½	
Cylinder Stocks:						
600 steam refined, light green	.07	.08	.07	.08	.0°	.10
600, steam refined, dark green	.04½	.05½	.04½	.05½	.05	.06
190-200 vis., D color, Bright Stocks	.26		.28		.28	
150-160 vis., D color, Bright Stocks 0-10 C.T.	.21	.22	.21	.22	.22	.23
150-160 vis., D color, Bright Stocks 10-25 C.T.	.20	.21				
150-160 vis., D color, Bright Stocks 25-40 C.T.	.19½	.20½				
150-160 vis., E color, Bright Stocks	.19	.20	.19	.20	.20	.22
Waxes:						
124-126 White Crude Scale Wax	.02	.02⅛	.02	.02⅛	.02	.02⅛

All bright stock prices are for domestic movement.

PENNSYLVANIA—						
34 Neutral	.05½	.06½	.05½	.06½	.05½	.06½
34 Sundebloom	.05½		.05½		.05½	
36 Miners' Neutral	.05¾		.05¾		.05¾	
150, 3 color	.11	.12½	.11	.12½	.11	.12½
180, 3 color	.15½	.16½	.15½	.16½	.15½	.16½
200, 3 color	.17	.17½	.17	.17½	.17	.17½
220, 3 color	.21	.22	.21	.22	.21	.22
600, steam refined	.09¾	.10¾	.10½	.11½	.11	.12
635, steam refined	.16	.17	.17	.18	.17	.18
650, steam refined	.15½	.16½	.15½	.16½	.15½	.16½
600, Pennsylvania Flash	.16	.17	.16	.17	.17	.18
630, Pennsylvania Flash	.24	.25	.24	.25	.24½	.25½
600, E filtered	.15	.17	.15	.17	.15	.17
600, D filtered	.18	.21	.19	.21	.19	.21
Pennsylvania Bright Stocks	.21	.22	.22	.23	.22	.23
*122-124 White Crude Scale Wax	.02¼		.02¼		.02¼	
124-126 White Crude Scale Wax	.02¼		.02¼		.02¼	

*At New York.

GULF COAST (South Texas)—						
100 vis., 2-2½ color, pale oil	.06¼	.06½	.06¼	.06½	.06¼	.06½
200 vis., 3 color, pale oil	.08½	.09	.08½	.09	.08½	.09
300 vis., 3 color, pale oil	.09¾	.10	.09¾	.10	.09¾	.10
500 vis., 3½ color, pale oil	.11	.11¼	.11	.11¼	.11	.11¼
750 vis., 3½ color, pale oil	.12½	.12¾	.12½	.12¾	.12½	.12¾
1,200 vis., 3½ color, pale oil	.15	.15¼	.15	.15¼	.15	.15¼
2,000 vis., 4 color, pale oil	.16	.16½	.16	.16½	.16	.16½
200 vis., 5-6 color, red oil	.07¾	.08	.07¾	.08	.07¾	.08
300 vis., 5-6 color, red oil	.09	.09¼	.09	.09¼	.09	.09¼
500 vis., 5-6 color, red oil	.10¼	.10½	.10¼	.10½	.10¼	.10½
750 vis., 5-6 color, red oil	.11¾	.12	.11¾	.12	.11¾	.12

REFINERY AND CRUDE PRICES

Quotations on refined products are for interstate or export movement unless otherwise noted.

1,200 vis., 5-6 color, red oil	.14	.14½	.14	.14½	.14	.14½
2,000 vis., 6 plus color, red oil	.16	.16¼	.16	.16¼	.16	.16¼
CALIFORNIA—						
130 vis., 2½-3 color	.09	.09½	.09	.09½	.09	.09½
200 vis., 2½-3 color	.10	.10¾	.10	.10¾	.10	.10¾
300 vis., 3-3½ color	.10¾	.11½	.10¾	.11½	.10¾	.11½
350 vis., 3½-4 color	.11½	.11¾	.11½	.11¾	.11½	.11¾
400 vis., 3½-4 color	.12¼	.12¾	.12¼	.12¾	.12¼	.12¾
Red Neutral:						
200 vis., 4½-5 color	.10	.10¾	.10	.10¾	.10	.10¾
300 vis., 5-6 color	.10¾	.11¼	.10¾	.11¼	.10¾	.11½
400 vis., 5-6 color	.12	.12½	.12	.12½	.12	.12½
500 vis., 4½-5 color	.13	.13½	.13	.13½	.13	.13½
500 vis., 5-6½ color	.13	.13¾	.13	.13¾	.13	.13¾
600 vis., 6½ plus color	.13½	.14½	.13½	.14½	.13½	.14½

Note—Bright stocks are not manufactured commercially on the Pacific Coast.

NEW YORK (BAYONNE) REFINERY PRICES

	Nov. 11		Nov. 4		Oct. 28	
Gasoline, U. S. Motor, 58-60, 437 e.p.	.06¾	.07	.07½	.08¼	.07½	.08¼
Kerosene, water white, 41-43	.06¾		.06¾		.06¾	
*Fuel Oil, Bunker "C," 41-43	1.05		1.05		1.05	
†Fuel Oil Diesel, 28-30, per bbl.	2.00		2.00		2.00	
Gas Oil, 28 gravity plus	.04¾	.05¼	.04¾	.05¼	.04¾	.05¼
25 pale Paraffin Oil, tank car	.10¼		.10¼		.10¼	
28 pale Paraffin Oil, tank car	.07¼		.07¼		.07¼	
280 red Paraffin Oil, tank car	.12½		.12½		.12½	
250 red Paraffin Oil, tank car	.11½		.11½		.11½	
225 red Paraffin Oil, tank car	.10		.10		.10	
200 red Paraffin Oil, tank car	.09¼		.09¼		.09¼	
Domestic heating oil, min. 32 grav., tank car	.04½		.04½		.04½	
Refined Wax:						
120-122 a.m.p., per lb.	.02⅞		.02⅞		.02⅞	
125-127 a.m.p., per lb.	.03⅛		.03⅛		.03⅛	
130-132 a.m.p., per lb.	.03½		.03½		.03½	
133-135 a.m.p., per lb.	.04¼		.04¼		.04¼	
135-137 a.m.p., per lb.	.04½		.04½		.04½	
Petrolatum in barrels, in carload lots, per pound:						
Dark Green	.01¾		.01¾		.01¾	
Amber	.03¼		.03¼		.03¼	
Extra Amber	.03⅜		.03⅜		.03⅜	
Cream	.06		.06		.06	
Lily White	.06¾		.06¾		.06¾	
Snow White	.08		.08		.08	

*Lighterage 5 cents a barrel extra. †Lighterage 6.5 cents per barrel.

NEW YORK (BAYONNE) EXPORT PRICES

	Nov. 11	Nov. 4	Oct. 28
600, steam refined cylinder stocks, in bbls.	.17	.17	.17
635, steam refined	.19	.19	.19
650, steam refined	.23½	.23	.23
600, Pennsylvania Flash	.24	.25	.25
630, Pennsylvania Flash	.30	.29	.29
600, Warren E	.24	.24	.24
600, Oil City E	.23	.23	.23
Light 140-150 Bright Stocks	.29	.29	.29
Dark 140-150 Bright Stocks	.27	.27	.27

LOS ANGELES EXPORT PRICES

	Nov. 11		Nov. 4		Oct. 28	
Kerosene, water white	.04¾	.06	.04¾	.06¼	.04¾	.06¼
*U. S. Motor Gasoline, 53-55, 437 e.p.	.06½	.07½	.06½	.07½	.06½	.07½
*60-62, 400 endpoint gasoline	.08	.09¼	.08	.09¼	.08¼	.09½

*Prices on coastwise shipments.

CRUDE OIL PRICES

OKLAHOMA, KANSAS, NORTH AND EAST CENTRAL TEXAS

Corsicana heavy (Oct. 28) ..... $ .75
Other fields ..... See gravity table

TEXAS PANHANDLE

Gray County, Wheeler County and Carson-Hutchinson Counties—See gravity table.

WEST TEXAS

Iatan* ..... Same as North Texas
Crane-Upton-Crockett, Howard and Glasscock, Mitchell and Ector ..... See gravity table, Column 3
Pecos and Winkler ..... See gravity table, Column 9
Chalk† (April 10, 1930) ..... $ .75

*Includes Westbrook Field. †Posted by Humble Oil & Refining Co.

ARKANSAS-NORTH LOUISIANA

Smackover (all grades) (Oct. 30, 1930) $ .70
Carterville, Sarepta and Cotton Valley, below 36 gravity ..... See gravity table
Bellevue (Oct. 30, 1930) 1.00
Urania (Oct. 30, 1930) ..... .75
Calion, heavy (Oct. 30, 1930) ..... .70
East El Dorado (Oct. 30, 1930) ..... .70
Other fields ..... See gravity table

Note—Smackover and Bellevue posted by Standard Oil Co. of Louisiana and Magnolia Petroleum Co.; Urania posted by Louisiana Oil Refining Corp.; East El Dorado posted by Gulf Refining Co. and Magnolia Petroleum Co. Calion posted by Gulf Refining Co.

GULF COAST

Grade A (Oct. 28, 1930)* $1.00
Grade B, 25° and upward .. See gravity table
Jennings, La. (Oct. 30, 1930)† ..... .80
Refugio (light) ..... Same as Grade B
Refugio (heavy) (Oct. 28, 1930)* ..... .75
Markham (Oct. 28)‡ ..... .85
High Island (Oct. 30, 1930)† ..... .75

*Humble Oil & Refining Co. ‡Texas Pipe Line Co. †Gulf Refining Co. of La.

ROCKY MOUNTAIN STATES
Ohio Oil Co.-Midwest Refining Co.

Iles (Feb. 15, 1930) ..... $ .87
33 gravity and above ..... .87
Under 33 gravity ..... .65
Dutton Creek (Oct. 28, 1930) 1.01
Rock Creek, Wyo. (Oct. 28, 1930) 1.01
Salt Creek ..... See gravity table
Big Muddy (Oct. 28, 1930) 1.00
Grass Creek, heavy (July 27, 1928) ..... .90
Grass Creek, light (Oct. 28, 1930) 1.25
Mule Creek (May 21, 1929) 1.20
Elk Basin (Oct. 28, 1930) 1.25
Lance Creek (Oct. 28, 1930) 1.33
Poison Spider (March 14, 1927) 1.00
Notches (March 14, 1927) ..... .65
Rex Lake (Feburary 22) 1.10
Osage (Oct. 28, 1930) 1.00
Lost Soldier (Oct. 28) ..... .80
Hamilton Dome (March 14, 1927) ..... .85
Greybull (Oct. 28, 1930) 1.25
Torchlight (Oct. 28, 1930) 1.25
Cat Creek (Oct. 28, 1930) 1.25
Pondera (Montana) (Oct. 28, 1930) 1.45
Sunburst (Montana) (Oct. 28, 1930) 1.55
Hogback (Feb. 15, 1930) 1.40
Artesia (New Mexico) (Oct. 28, 1930) ..... .75
Lea County ..... See gravity table

Note—Salt Creek, Osage, Cat Creek, Greybull and Hogback posted by Midwest Refining Co., and the remainder by the Ohio Oil Co. Both companies posted Grass Creek light and Elk Basin. Lost Soldier posted by Producers & Refiners Corp. Artesia posted by Ohio Oil Co. and Continental Oil Co.

SOUTH CENTRAL AND SOUTHWEST TEXAS

Darst Creek (Oct. 28, 1930)* ..... $ .90

(Continued on Page 220)

CRUDE OIL GRAVITY TABLE

Gravity—	1 Oklahoma-Kansas N. C. Texas	2 North La.-Ark.	3 Crane, Upton, Ector, Crockett, Howard, Glasscock, Mitchell, (West Texas) Lea, N. M.	4 Wheeler County (Texas Panhandle)	5 Gray County (Texas Panhandle)	6 Carson and Hutchinson (Texas Panhandle)	7 Salt Creek, Wyo.	8 Stephens, Ark.	9 Pecos-Winkler (West Texas)	10 Grade B Gulf Coast and Refugio Texas
Below 25	....	....	.50	....	....	....	....	....	.55	.75
25 to 25.9	....	....	.52	....	....	....	....	....	.57	.92
26 to 26.9	....	....	.54	....	....	....	....	....	.59	.94
27 to 27.9	....	....	.56	....	....	....	....	....	.61	.96
28 to 28.9	....	....	.58	....	....	....	....	....	.63	.98
Below 29	.65	.65	....	....	.50	.45	....	.54	....	....
29 to 29.9	.69	.69	.60	....	.54	.49	.69	.58	.65	1.00
30 to 30.9	.73	.73	.62	....	.58	.53	.73	.62	.67	1.02
31 to 31.9	.77	.77	.64	....	.62	.57	.77	.66	.69	1.04
32 to 32.9	.81	.81	.66	....	.66	.61	.81	.70	.71	1.06
33 to 33.9	.85	.85	.68	....	.70	.65	.85	....	.73	1.08
34 to 34.9	.89	.89	.70	....	.74	.69	.89	....	.75	1.10
35 to 35.9	.92	.92	.72	....	.77	.72	.92	....	.77	1.12
36 to 36.9	.95	.95	.74	....	.80	.75	.95	....	.79	1.14
37 to 37.9	.98	.98	....	....	.83	.78	.98	....	....	1.16
38 to 38.9	1.01	1.01	....	....	.86	.81	....	....	....	1.18
39 to 39.9	1.04	1.04	....	....	.89	.84	....	....	....	1.20
40 and above	1.07	1.07	....	....	.92	.87	....	....	....	1.33

Column 1—Carter Oil Co. posted above prices for Oklahoma and Kansas on October 28. Humble Oil & Refining Co. posted same for North Central Texas on October 28. Magnolia Petroleum Co. posted same for Kansas, Oklahoma, and North Central Texas on October 27 from 29 degrees upward, but posted below 26 degrees at 53 cents; 26-26.9 degrees at 57 cents; 27-27.9 degrees at 61 cents; 28-28.9 degrees at 65 cents. Standolind Crude Oil Purchasing Co. on November 1 adopted the schedule as listed in table; Prairie Oil & Gas Co. adopted the same on November 1, other companies following. North Central Texas, for the purpose of this table, includes North Texas, Ranger district, Mexia, Powell, Richland, Wortham, Van, Lytton Springs, Currie, Nocona, Moran and Corsicana (light oil).

Column 2—The Texas Company posted above prices on Caddo and Red River crude, up to 39-39.9 degrees. It also posted 40-40.9 degrees at $1.07; 41-41.9 degrees at $1.10; 42-42.9 degrees at $1.13; 44-44.9 degrees at $1.16, and 44 degrees and above $1.19. Standard Oil Co. posted schedule as listed in table on October 30; Magnolia Petroleum Co. on October 30 posted prices as listed, starting at 29 degrees, but posted below 26 degrees, 53 cents; 26-26.9 degrees, 57 cents; 27-27.9 degrees, 61 cents; 28-28.9 degrees, 65 cents. Louisiana Oil Refining Co. adopted Standard of Louisiana prices on October 30. North Louisiana and Arkansas fields included in table are Caddo, Bull Bayou, Crichton, De Soto, Haynesville, Homer, Cotton Valley, Sarepta-Carterville, El Dorado and Rainbow.

Column 3—Posted by Humble Oil & Refining Co. on October 28.
Column 4—Companies quit posting but crude takes present Hutchinson-Carson prices.
Column 5—Humble Oil & Refining Co.
Column 6—Humble Oil & Refining Co., Magnolia and Prairie, October 28.
Column 7—Midwest Refining Co. on October 28. All crude over 37 degrees 98 cents.
Column 8—Louisiana Oil & Refining Co. and Atlantic Oil Producing Co., October 30.
Column 9—Humble Oil & Refining Co., October 28.
Column 10—Humble Oil & Refining Co., October 28. On October 30, Gulf Refining Co. of La. and Gulf Pipe Line Co. of Texas posted as follows for Grade B: Below 25 degrees, 69 cents; 25-25.9 degrees, 71 cents, with a 2-cent differential for each degree upward to and including 40 degrees and above at $1.01. The Texas Company adopted above schedule November 1.

CALIFORNIA CRUDE OIL PRICES

Standard Oil Co. (effective September 15, 1930), Union Oil Co. (effective September 15, 1930)

Gravity—	1 Long Beach, Seal Beach, Alamitos Hts., Huntington Beach, Inglewood, Torrance, Richfield, Olinda, Brea Canyon	2 Whittier, La Habra, Coyote Hills	3 Midway-Sunset, Elk Hills, Lost Hills, Belridge, Buena Vista Hills	4 Montebello	5 Santa Fe Springs	6 Santa Maria, Coalinga	7 Wheeler Ridge	8 Orcutt, Ventura, Rincon	9 Ventura Avenue	10 Elwood Terrace	11 Athens, Rosecrans, Dominguez
14 to 14.9	.70	.70	.55	.70	....	.55	.55	.55	.70	....	....
15 to 15.9	.70	.70	.55	.70	....	.55	.55	.55	.70	....	....
16 to 16.9	.70	.70	.55	.70	....	.55	.55	.55	.70	....	....
17 to 17.9	.70	.70	.55	.70	....	.55	.55	.55	.70	....	....
18 to 18.9	.76	.76	.62	.71	....	.62	.62	.65	.76	....	....
19 to 19.9	.82	.82	.70	.77	....	.70	.70	.75	.82	....	....
20 to 20.9	.88	.87	.78	.83	....	.78	.78	.78	.88	....	....
21 to 21.9	.94	.93	.86	.90	.93	.86	.86	.90	.91	....	....
22 to 22.9	1.00	.98	.94	.97	.96	.94	.94	.95	.94	....	....
23 to 23.9	1.07	1.04	1.02	1.05	1.01	1.02	1.02	1.02	1.00	....	....
24 to 24.9	1.12	1.08	1.06	1.08	1.05	1.04	1.04	1.08	1.05	....	1.13
25 to 25.9	1.17	1.12	1.10	1.11	1.09	1.06	1.06	1.11	1.10	....	1.17
26 to 26.9	1.22	1.16	1.14	1.15	1.13	1.08	1.08	1.15	1.15	....	1.22
27 to 27.9	1.26	1.21	1.18	1.19	1.18	1.11	1.10	....	1.19	....	1.27
28 to 28.9	1.30	1.25	1.23	1.23	1.23	1.16	....	....	1.23	....	1.33
29 to 29.9	1.34	1.29	1.29	1.26	1.28	1.19	....	....	1.27	....	1.37
30 to 30.9	1.38	1.33	1.35	1.29	1.33	1.23	....	....	1.31	....	1.42
31 to 31.9	1.43	....	1.40	....	1.38	1.27	....	....	1.36	....	1.47
32 to 32.9	1.48	....	1.47	....	1.43	1.31	....	....	1.41	....	1.52
33 to 33.9	....	....	1.53	....	1.48	1.35	....	....	1.47	....	1.57
34 to 34.9	....	....	1.59	....	1.53	1.39	....	....	1.53	1.32	1.63
35 to 35.9	....	....	1.65	....	1.58	1.43	....	....	1.59	1.39	1.66
36 to 36.9	....	....	....	....	1.63	....	....	....	....	1.46	1.72
37 to 37.9	....	....	....	....	1.68	....	....	....	....	1.53	1.78
38 to 38.9	....	....	....	....	1.73	....	....	....	....	1.60	1.84
39 to 39.9	....	....	....	....	1.78	....	....	....	....	1.66	1.90
40 to 40.9	....	....	....	....	....	....	....	....	....	1.72	1.96
41 to 41.9	....	....	....	....	....	....	....	....	....	1.78	2.02
42 to 42.9	....	....	....	....	....	....	....	....	....	1.84	2.08

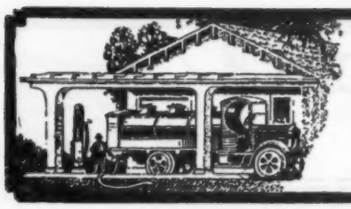
Kern River, Newhall-McKittrick, Mount Poso and Round Mountain, 11 to 13.9 gravity, 50 cents; 14 gravity and above, 55 cents, effective March 11. On March 11 the Union Oil Co. posted Midway-Sunset, Elk Hills, Buena Vista, Lost Hills and Coalinga crude as follows: 11 to 13.9 gravity at 50 cents. Fruitvale, posted by General Petroleum Co., 11-13.9, 50 cents; 14 gravity and above, 55 cents.

Column 1—Signal Hill, Seal Beach, Huntington Beach and Alamitos Heights crude, 14 to 32.9 gravity, inclusive; Richfield, Olinda-Brea and Fullerton, 14 to 30.9 gravity; Torrance and Inglewood, 14 to 28.9 gravity.

Column 2—Whittier crude, 14 to 22.9 gravity; Coyote Hills, 14 to 30.9 gravity.

Column 3—Kern River, Newhall and McKittrick, 11 to 19.9 gravity; Midway-Sunset, Buena Vista and Elk Hills, 11 to 33.9 gravity; Lost Hills, 11 to 34.9 gravity; oil below 14 gravity posted at 50 cents.

(Continued on Page 224)



TANK WAGON MARKETS

Tank wagon quotations for gasoline and kerosene in United States as furnished by the larger marketing concerns Nov. 11

ALL TANK WAGON AND SERVICE STATION QUOTATIONS INCLUDE TAXES

STANDARD OIL CO. (INDIANA)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Chicago†	16.0	17.0	3.0	11.0
Decatur, Ill.	16.4	16.4	3.0	11.0
E. St. Louis	15.7	14.7	3.0	10.2
Joliet	16.4	17.4	3.0	11.0
Peoria	15.0	14.0	3.0	11.0
Quincy	16.2	17.2	3.0	10.8
Davenport, Ia.	16.5	16.5	3.0	11.3
Des Moines	15.5	15.5	3.0	11.3
Keokuk	16.5	17.5	3.0	11.3
Sioux City	16.1	14.9	3.0	10.9
Duluth, Minn.	17.5	16.4	3.0	11.9
Mankato	14.0	14.0	3.0	11.7
Minneapolis	17.0	17.0	3.0	11.9
La Crosse, Wis.	16.2	17.2	2.0	12.0
Milwaukee	15.1	15.0	2.0	10.9
Madison	15.3	15.3	2.0	11.1
Detroit, Mich.	16.8	13.9	3.0	12.7
Grand Rapids	15.7	16.7	3.0	12.6
Saginaw	14.3	16.9	3.0	12.8
Evansville, Ind.	17.1	18.1	4.0	11.9
Indianapolis	16.9	17.9	4.0	12.1
South Bend	17.4	18.4	4.0	12.2
Fargo, N. D.	18.9	19.9	3.0	13.9
Huron, S. D.	17.5	17.5	4.0	12.7
Sioux Falls	17.8	14.9	4.0	12.4
K. C., Mo.	14.9	15.9	3.0	9.6
Springfield*	15.9	16.9	3.0	10.5
St. Louis*	12.9	13.9	2.5	10.3
St. Joseph	15.5	11.9	2.0	10.1
Wichita, Kans.	14.8	13.8	3.0	9.8
Bartlesville, Ok.	15.5	18.5	4.0	9.5

*State tax 2 cents; remainder city tax.

†Effective June 3, discounts on Q.D.A. in Chicago district 4 cents off service station price on purchases of 500 gallons or more per month and 5 cents on purchases of 1,000 gallons or more per month.

Effective August 5, the following quantity discounts from the service station prices are allowed on monthly sales of gasoline; 500 gallons or more, 3 cents; 75,000 gallons or more, 4½ cents. Discounts are allowed each month and they are not cumulative. Delivery tickets showing date and quantity delivered must be sent to the seller before the tenth of the month to secure the discount on the previous month's purchases.

ROCKY MOUNTAIN DISTRICT

Continental Oil Co.

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Denver, Colo.	16.0	19.0	4.0	13.5
Pueblo	17.0	20.0	4.0	13.5
Grand Junction	18.0	21.0	4.0	17.0
Casper, Wyo.	17.0	20.0	4.0	12.0
Cheyenne	18.0	21.0	4.0	13.5
Butte, Mont.	19.0	22.0	5.0	18.0
Billings	20.0	23.0	5.0	16.5
Great Falls	20.0	23.0	5.0	18.0
Helena	22.5	25.5	5.0	18.0
Salt Lake, Utah	20.0	22.0	3.5	17.0
Albu'que, N. M.	16.0	18.0	5.0	15.0
Boise, Idaho	23.5	26.5	5.0	19.0
Twin Falls	23.5	27.5	5.0	19.0

SOUTHWESTERN DISTRICT

Magnolia Petroleum Co.

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Dallas, Tex.	14.0	17.0	4.0	11.0
Fort Worth	14.0	17.0	4.0	10.0
Houston	15.0	19.0	4.0	11.0
San Antonio	13.0	17.0	4.0	11.0
El Paso	16.0	20.0	4.0	13.0
Texarkana	17.0	17.0	4.0	12.0
Muskogee*	15.0	18.0	4.0	9.0
Okla. City*	13.0	16.0	4.0	10.0
Tulsa	14.0	18.0	4.0	10.0
Ft. Smith, Ark.	14.5	15.5	5.0	12.0
Little Rock	13.0	14.0	5.0	12.0

*Gasoline tank wagon price to dealers 1 cnt under posted tank wagon.

One-cent rebate made from posted station prices to cash purchasers in Louisiana, Arkansas and Tennessee.

NEBRASKA

Standard Oil Co. (Nebraska)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Omaha	17.25	18.25	4.0	11.25
McCook	18.75	20.75	4.0	12.75
Norfolk	17.25	17.25	4.0	11.75
N. Platte	18.75	20.75	4.0	12.50
Scott's Bluff	17.00	17.00	4.0	12.25

OHIO

Standard Oil Co. (Ohio)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Ohio points*	18.0	19.0	4.0	†15.0

*Dealers and commercial accounts 2 cents under tank wagon.

†Service station price 16 cents.

CENTRAL SOUTH DISTRICT

Standard Oil Co. (Louisiana)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
N. Orleans, La.*	13.5	14.5	5.0	12.0
Baton Rouge	14.5	15.5	4.0	13.0
Alexandria†	15.5	16.5	5.0	13.0
Lafayette*	15.5	16.5	5.0	13.0
Lake Charles*	15.5	16.5	5.0	13.0
Shreveport	14.5	15.5	4.0	13.0
Knoxville, Tenn.	18.0	19.0	5.0	15.0
Memphis	16.0	17.0	5.0	12.5
Chattanooga	17.5	18.5	5.0	13.0
Nashville	17.0	18.0	5.0	15.0
Bristol	19.0	20.0	5.0	14.0
Lt. Rock, Ark.	15.0	16.0	5.0	12.0

*Includes city tax of 1 cent. Louisiana kerosene prices include 1-cent state tax. New Orleans kerosene price also includes 1-cent city tax.

†Gasoline price at Alexandria includes 1-cent tax in parish of Rapides.

One cent discount allowed off station price on all cash purchases. All other station discounts withdrawn October 2, 1930.

Two-cent discount off gasoline tank wagon price to dealers and commercial accounts.

ATLANTIC COAST DISTRICT

Standard Oil Co. (New Jersey)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Atlanta, Ga.	20 0	22 0	6 0	13 5
Newark	13.5	14.5	2.0	10.5
Annapolis, Md.	16.0	17.0	4.0	11.0
Baltimore	15.2	16.2	4.0	9.5
Cumberland	17.0	18.0	4.0	12.0
Wash'gton, D.C.	13.7	14.7	2.0	10.7
Danville, Va.	17.8	18.8	5.0	11.8
Norfolk	16.3	17.3	5.0	10.0
Petersburg	17.3	18.3	5.0	11.3
Roanoke	18.0	18.0	5.0	12.0
Richmond	16.7	17.7	5.0	10.7
Charles'n, W.Va.	16.5	17.5	4.0	11.5
Keyser	17.1	18.1	4.0	12.0
Clarkersburg	15.2	16.2	4.0	10.2
Wheeling	16.4	17.4	4.0	11.4
Charlotte, N. C.	18.3	19.3	5.0	12.3
Hickory	18.6	19.6	5.0	12.6
Mt. Airy	18.5	19.5	5.0	12.5
Salisbury	18.5	19.5	5.0	12.5
Charleston, S. C.	17.3	18.3	6.0	10.3
Columbia	19.2	20.3	6.0	12.3

A 2-cent per gallon discount off the gasoline tank wagon price is offered to dealers.

SOUTHERN DISTRICT

Standard Oil Co. (Kentucky)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Atlanta, Ga.	20.0	22.0	6.0	13.5
Augusta	20.0	22.0	6.0	15.5
Macon	20.0	22.0	6.0	13.0
Savannah	20.0	22.0	6.0	14.0
Birm'ham, Ala.	18.0	20.0	5.0	14.5
Mobile	17.0	19.0	4.0	11.5
Montgomery	18.0	20.0	4.0	15.0
Clarks'le, Miss.	18.0	20.0	5.0	12.5
Jackson	15.0	17.0	5.0	13.0
Natchez	18.0	20.0	5.0	13.0
Gulfport	19.0	19.0	5.0	13.0
Vicksburg	18.0	20.0	5.0	13.0
Jack'ville, Fla.	17.0	19.0	6.0	14.0
Miami	19.0	21.0	6.0	14.0
Pensacola	20.0	21.0	6.0	13.5
Tampa	18.0	20.0	5.0	13.0
Lexington, Ky.	17.0	18.0	5.0	14.5
Covington	18.0	20.0	5.0	14.5
Louisville	16.0	18.0	5.0	12.0
Ashland	18.0	20.0	5.0	15.0
Catlettsburg	18.0	20.0	5.0	15.0

In addition to the state tax of 4 cents on gasoline, Montgomery has city tax of 1 cent on gasoline and one-half on kerosene. Kerosene prices in Georgia include 1-cent tax. In Florida, an inspection fee of 0.125 cent; in Alabama, an inspection fee of one-half cent on kerosene and one-fourth cent on gasoline. To Pensacola, Montgomery, Birmingham and Mobile state taxes and 1-cent levy tax. To Gulfport state tax add privileg tax of 2 cents.

Effective April 2, price to dealers 2 cents under posted tank wagon price.

NEW YORK AND PART OF NEW ENGLAND DISTRICT

Standard Oil Co. (New York)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Albany, N. Y.	15.6	17.6	2.0	15.6
New York*	14.3	16.3	2.0	14.3
Buffalo	17.8	19.8	2.0	14.8
Rochester	18.0	20.0	2.0	14.0
Syracuse	18.8	20.8	2.0	14.8
Boston, Mass.	14.5	16.5	2.0	13.5
Augusta, Me.	19.8	21.8	4.0	14.8
Manch't'r, N.H.	19.4	21.4	4.0	14.0
Burlington, Vt.	19.6	21.6	4.0	15.3

*Prices in steel barrels.

PENNSYLVANIA—DELAWARE AND PART NEW ENGLAND

The Atlantic Refining Co.

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Pittsburgh, Pa.	14.0	19 0	...	12.0
Philadelphia	14.0	19 0	...	12.0
Scranton	14.0	19.0	...	12.0
Allentown	14 0	19 0	...	12 0
Altoona	14 0	19 0	...	12 0
Erie	14.0	18.0	...	11 0
Dover, Del.	17 0	19 0	3 0	12.0
Wilmington	17 0	19 0	3.0	12.0
Springf'd, Mass.	17.5	19.5	2.0	10.0
Worcester	17.3	19.3	2.0	10.0
Boston	14.5	16 5	2 0	10.0
Providence, R.I.	12.7	14 7	2.0	10 0
Hartford, Conn.	17 5	19.5	2 0	10 0
New Haven	17.6	19.6	2.0	10 0

*Includes tax of 3 cents. Pennsylvania tax is collected by the dealer and paid by him direct to the State. The Atlantic Refining Co. recognizes a 2-cent per gallon discount on gasoline from its posted tank wagon markets on sales to dealers for purposes of resale. The Atlantic Refining Co. also recognizes a maximum discount of 2 cents per gallon on gasoline to commercial accounts under contract for one year.

PACIFIC COAST TERRITORY

Standard Oil Co. (California)

	Gasoline			Kero.
	Wh'sale price	Retail price	Incl'ds tax of	tank wagon
Fresno	23.0	21 0	3.0	17.0
San Francisco	23.0	21.0	3.0	15.5
Los Angeles	22.5	20.5	3.0	15.5
Reno, Nev.	28.0	26.0	4.0	19.0
Portland, Ore.	24.5	22.5	4.0	16.5
Seattle, Wash.	23.5	21.5	3.0	16.5
Tacoma	23.5	21.5	3.0	16.5
Spokane	27.5	25.0	3.0	20.5
Phoenix, Ariz.	19.5	22.5	4.0	20.0

Above prices are at company's plant or depots as company does not operate stations. A 6-cent per gallon discount is given dealers and customers taking tank wagon lots except in Phoenix where the discount is 1 cent.

STANOLIND FURNACE OIL IN CHICAGO

Less than 100 gallons	9.0
100 to 349 gallons	8.0
350 gallons or more	7.5

Note—Outside Chicago furnace oil discount of 1 cent per gallon is given on deliveries of 100 to 349 gallons and 1½ cents on deliveries of 350 gallons or more.

NAPHTHA

	Tank wagon	Tank car
Oleum spirits	14.7	10.0
V.M.&P. naphtha	16.7	12.0
Cleaner's naphtha	17.0	14.9
Stanisol	17.0	15.4

Tank wagon prices f.o.b. Chicago; tank car prices f.o.b. Whiting.

TANK WAGON CHANGES

The Atlantic Refining Co. announced reductions of 1 cent in tank wagon and service station prices for gasoline, effective November 7, in Pittsburgh, Philadelphia, Scranton, Allentown and Altoona, Pa., and in Dover and Wilmington, Del. The tank wagon price was reduced 1 cent in Erie, Pa., but the service station price remained at 18 cents. The tank wagon and station prices were reduced from 16.5 and 18.5 to 14.5 and 16.5 cents in Boston, Mass., and the tank wagon price was reduced 1 cent in Providence, R. I., making the new price 12.7 cents. The tank wagon price for kerosene was reduced from 12 cents to 11 in Erie; from 12.5 to 10 cents in Hartford, Conn., and from 12.6 to 10 cents in New Haven, Conn.

The Continental Oil Co. November 6 reduced the tank wagon price of gasoline from 20.5 cents to 18 and the service station price from 23.5 to 21 cents.

The Standard Oil Co. (Louisiana) November 3 reduced the price of gasoline 1 cent in Arkansas, making the new prices in Little Rock, tank wagon 13 cents and service station 14 cents. It advanced these prices 2 cents November 7, making the new prices 15 and 16 cents. November 5 the company reduced the tank wagon and station prices 1 cent in Chattanooga, Knoxville, Memphis and Nashville, Tenn.

The Standard Oil Co. (Kentucky) reduced the tank wagon price of kerosene in Atlanta, Ga., from 14.5 cents to 13.5.

PRICES ON ETHYL GASOLINE

CHICAGO, Nov. 10.—When the latest price cut was made in Detroit, Mich., the Standard Oil Co. (Indiana) which followed the reduction the next day, made an exception of its Red Crown Ethyl Gasoline. At the same time the other companies which handled Ethyl made the price of Ethyl Gasoline 3 cents above the low price fixed. The action is allowable under present conditions. When the jobber is not the cause of the cut prices in his locality and maintains the spread between the white gasoline and the Ethyl product, no notice is taken of the act on the part of the dealer. One reason for this is that it has been found difficult to sell Ethyl Gasoline at more than the regular spread of 3 cents. Distributors who handle Ethyl Gasoline, have found, they say, that when the spread becomes 4 cents the sale is reduced materially, and that if the reduction in the price of the regular gasoline is 2 cents, making the spread between the two gasolines 5 cents, the sale drops off so that there is no profit in handling the premium gasoline.

CRUDE OIL PRICES

(Continued from Page 219)

Luling (Oct. 28)†	.75
Mirando (Oct. 28, 1930)*	.75
Pettus (Oct. 28, 1930)*	1.10
Salt Flat (Oct. 28, 1930)*	.90
Thrall‡	
Lytton Springs (Lockhart). See gravity table	
Dobrowolski (Oct. 25, 1930)‖	
Same as Mid-Continent gravity scale	
Somerset (Oct. 25, 1930)¶	
Same as Mid-Continent gravity scale	

*Posted by Humble Oil & Refining Co. and Magnolia Petroleum Co. †Magnolia Petroleum Co., Humble Oil & Refining Co., Crown Central Pipe Line Co. ‡Thrall prices same as North Central Texas less 19½ cents per cwt. freight. ¶Grayburg Oil & Refining Co. ‖Pioneer Oil & Refining Co.

EASTERN STATES

Joseph Seep Purchasing Agency

(Effective Nov. 1, 1930)

Seep Purchasing Agency withdrew from Bradford and Allegany Fields as a purchaser on May 16.

Penna Grade Oil in National Transit Lines (Pennsylvania)	$2.00
Penna Grade Oil in Southwest Pennsylvania Lines (Pennsylvania)	1.95
Penna Grade Oil in Eureka Pipe Line Lines (West Virginia)	1.85
Penna Grade Oil in Buckeye Pipe Line Lines (Ohio) (Sept. 14, 1930)	1.60
Corning Grade Oil in Buckeye Pipe Line Co.'s Lines (Oct. 28, 1930)	1.30
Somerset Oil in Eureka Pipe Line Lines (Kentucky) (August 1, 1930)	1.14
Ragland Grade Oil in Cumberland Pipe Lines (Kentucky)	1.10
Wayne District Oil in Cumberland Pipe Lines	1.17

Tide Water Pipe Co.

Bradford district (Nov. 1, 1930)	$2.30
Allegany district (Nov. 1, 1930)	2.30

Pure Oil Co.

Cabin Creek, W. Va. (Nov. 1, 1930)	$2.00
Kelly Creek, W. Va. (Nov. 1, 1930)	2.00
Bradford Hollow, W. Va. (Oct. 1, 1930)	2.00

MIDDLE WESTERN STATES

Ohio Oil Co.

(Effective Oct. 28, 1930)

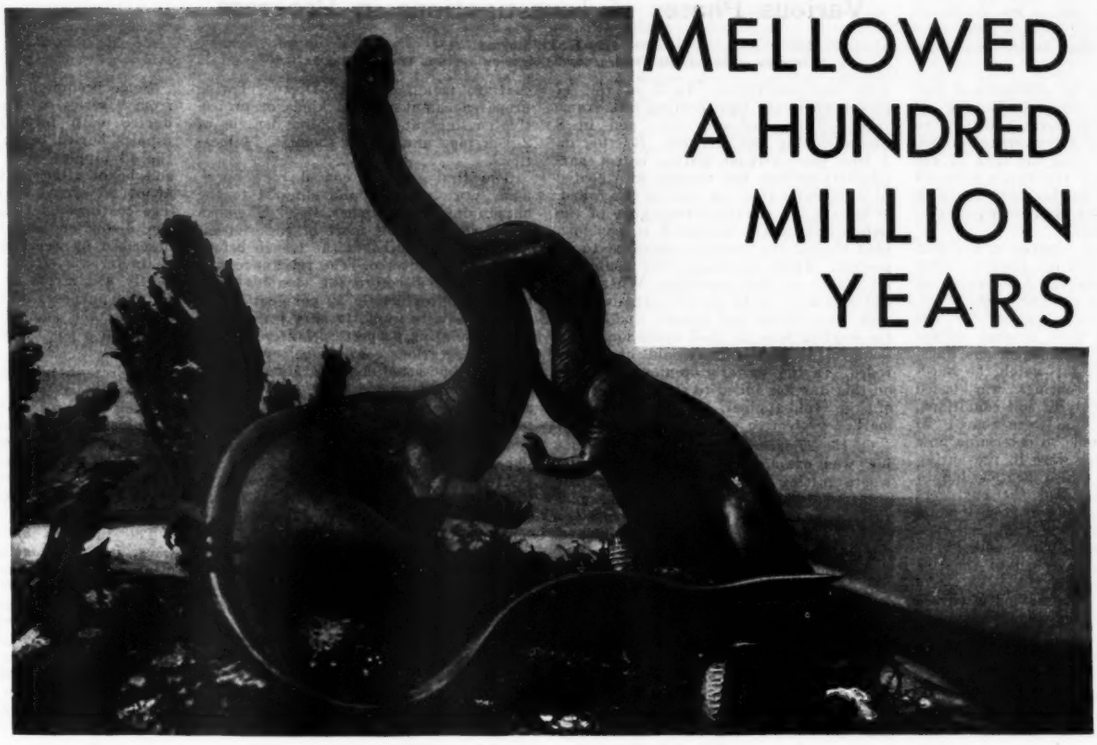
Lima	$1.10
Wooster	1.40
Illinois	1.30
Indiana	.87
Princeton	1.30
Plymouth	.88
Western Kentucky	1.15
Midland, Mich.*	1.10
Dundee, Mich. (Oct. 28)‖	
Same as Mid-Continent gravity scale	
Upper and Lower Traverse Sands, Mich. (Oct. 28)‖	
Same as Mid-Continent gravity scale	
Cumberland, Clay, Barren, Clinton and Monroe Counties, Kentucky (Oct. 28)‡	.85
Oil City, Ky.‖	1.10
Oil Springs (Canada) (Oct. 28)¶	1.57
Petrolia (Canada) (Oct. 28)¶	1.50

*Posted by Pure Oil Co. ‡Posted by Paragon Development Co. ‖Posted by Stoll Refining Co. ¶Posted by Imperial Oil Co., Ltd. ‖Posted by Standard of Indiana for boat shipment.

MEXICAN CRUDE

Panuco*	$0.56

*F.o.b. ship, based on October transactions and exclusive of taxes and bar dues.



MELLOWED A HUNDRED MILLION YEARS

At last . . . a pure PENNSYLVANIA grade motor oil for easy starting . . . AND EASY SALES . . . in winter!

Motorists by the thousands saw this startling, striking series of prehistoric monsters . . . in magazines, newspapers and rotogravures from coast to coast. Then that line *"Mobiline is guaranteed to flow at zero"* caught their eyes. And now they ask for Sinclair Mobiline!

No longer need your Pennsylvania oil customers change to another motor oil for winter driving. The wax that thickens and hardens Pennsylvania oils on cold, wintry days is virtually stripped from Mobiline at as low as 60° F. below zero. This dewaxing process, requiring new oil separators whirling at 15,000 revolutions a minute, takes place in the Sinclair refinery at Wellsville, N. Y. . . . the newest and largest single refinery using Pennsylvania grade crude exclusively.

Here Sinclair Mobiline is refined 100% from Bradford-Allegany crude . . . formed in the Devonian Age, a hundred million years ago . . . the costliest of all Pennsylvania crudes! Here this famous crude is triple-filtered to remove all carbon-forming compounds . . . Mobiline retains its clear greenish color long after other oils have turned black in the crankcase.

Just think it over . . . this striking sales story behind Sinclair Mobiline! You can't beat it! With Sinclair Mobiline this winter you get away from cold weather complaints . . . and get more satisfied, steady customers. Stock up now — winter's here!

Sinclair Refining Company (Inc.), New York, Atlanta, Chicago, Fort Worth, Houston, Kansas City. Sinclair Refining Company of Canada, Ltd., Toronto. Sinclair Refining Company of California, Los Angeles.

SINCLAIR MOBILINE

Reg. U. S. Pat. Off. 1905, Renewed 1875

Pennsylvania MOTOR OIL

Made in the newest, largest single refinery using PENNSYLVANIA grade crude exclusively.

Guaranteed by SINCLAIR REFINING CO. INC. to be 100% pure PENNSYLVANIA GRADE OIL

35¢ *per quart*

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Report on Underground Corrosion

Summary From Bureau of Standards Section on Various Phases of Investigations in Progress

By K. H. Logan
Bureau of Standards Underground Corrosion Section, Washington, D. C.*

The investigation of underground corrosion undertaken by the Bureau of Standards has several parts, and involves the co-operation of many organizations.

During the past year the time of the American Petroleum Institute's research associate, G. N. Scott, has been taken in starting the so-called three-cornered tests of protective coatings.

The following is an abstract of a report prepared by Scott Ewing, research associate of the American Gas Association, on the examination of a gas line in the West.

The line which was chosen for the study appeared to have several advantages. It is one of the longest gas lines, and among the first for which the selection of protective coatings was based upon a scientific study of soil conditions. Only parts of the line were coated, so that one might be able to determine how effective the coatings were in preventing corrosion. It might also be possible to determine how successful the engineers had been in identifying corrosive soils along the line. The line has been laid for about two years, which should be sufficient time for the effect of the soil on the line to be noted.

In order to have some method of choosing locations to inspect the line, and to get a picture of the soils along the line, a rough soil map of the line was made before the inspection work started.

Report on Gas Line

With the aid of the soil map, locations to be inspected were chosen which appeared to represent average conditions within each soil series. Several inspections were made in a few of the series. By noting the kinds of coatings that were used on the line, one sees in general that the heavy coatings were placed where the soil has the appearance of being corrosive, and that no coatings were used in soils that appear to be free from alkali and excess water. Although, as is usually the case, there were numerous difficulties to be overcome in constructing and coating the line, the writer is of the opinion, from his inspection of the line, that the coatings were applied in a workmanlike manner and with careful supervision.

Over a large part of the line the lower part of the backfill is still loose, just as it was when placed in the trench. The top of the backfill, to a depth of about 1 foot, was slightly compacted, showing that it had been wet to about this depth. In the vicinity of irrigation ditches or low places, or placed where the backfill has been cut to let surface water cross the trench, the backfill was well compacted and often rather moist.

All of the measurements of the resistance of the enamel coatings are surprisingly low, even though the coating appeared to be unaffected. They show that the enamel coating, which is one of the best from an electrical standpoint, does not maintain its nonconducting properties after it has lain underground for two years, and are in agreement with the numerous electrical laboratory tests of protective coatings which have been made by the Bureau of Standards. All of the samples of enamel foamed when they were melted. This was probably due to the moisture they contain. As the coating becomes distorted, the resistance gets still lower; so that there is a general correspondence between the resistance of the enamel coating and its condition.

Condition of Pipe

In 7 of the 21 places where bare pipe was examined, the pipe was found pitted or corroded; in 7 other places some rusting had occurred, and in 7 places the pipe was unaffected. In 3 of the 17 places where the light coating was examined, pitting had occurred; and in 8 places rusting had occurred. Rusting on a bare pipe without pitting is not particularly serious, but rusting on a coated pipe indicates that the coating has failed. Wherever the electrical resistance of the light coatings was measured, it was low, even though the coatings appeared to be perfect. These coatings were found in all stages of disintegration. Where the soil appeared to be at all corrosive, the pipe was rusted and pitted; and where the coating was in good condition, it is doubtful if bare pipe would have corroded. In the writer's opinion the work on this line has failed to show that either of the cold-applied coatings has any marked protective value.

Of the 27 places where the heavy coating was examined, only 3 were found where pitting or serious corrosion had occurred; while in 7 other places some rust was found. When one considers that the heavy coating was applied in the most corrosive soils, it is evident that it had retarded corrosion.

In a total of 27 places where the enamel coatings were examined, 3 places were found where the pipe was rusted or pitted because the enamel had cracked. These cracks were formed before the pipe was placed in the trench, according to the inspector who was there when the coating was applied. The cracks formed because the enamel was so hard that it was unable to adjust itself to the sudden temperature changes. Many of the cracks were found to have healed since the pipe was laid; but in the two places where the soil was corrosive, many of the cracks were filled with rust.

Distortion Principal Cause

There is little doubt that the principal cause of failure of the enamel is the distortion it suffers. In only 11 of the 27 places where the enamel was inspected was it found free from distortion, and 2 of these undistorted coatings had cracked. The worst distortion appeared to be associated with heavy soils, and it was worst in practically all cases over the top quarter of the pipe.

The distortion phenomena which were observed on this line can all be explained in the following way: Distortion is caused by uneven pressure of the backfill. Light-textured or sandy soils show no distortion, because they do not form clods, and hence exert a uniform pressure on the coating surface. Heavy soils form hard fragments which press on the coating only in places, so that the coating yields and flows away from the clods. The interrelation between the hardness of the enamel as measured by its melting point, the colloidal content of the soil, and the distortion of the coatings are clearly shown from the data obtained.

The results of this study indicate that if an enamel is used as a pipe coating, it should be hard, because the harder the enamel the better it resists soil action. The only limit to hardness is the tendency of the enamel to crack. Since a much harder enamel can be used in warm weather, it is a decided advantage to apply it then.

There is a fair correlation between the soil types as mapped and the recommendations resulting from the corrosion survey which was made of the line before it was laid. From the results of the inspections, data are presented which show that in this region coating recommendations as accurate as those made for this line can be made by making a soil map and measuring the resistivity of a number of soil samples, taken with proper care along the line.

In 1929, with the co-operation of the coating manufacturers, Doctor Ewing prepared samples of 42 kinds of protective coatings applied to 2-foot lengths of 2-inch pipe and buried them in 14 locations.

The first sets of coated pipe specimens were removed and shipped to the bureau during September, 1930. The electrical resistance of most of these specimens was measured in the trench before they were uncovered. The resistance was also measured before the samples were buried. Approximately 10 per cent of the specimens were found to have maintained their insulating properties. Different soils affect the various coatings somewhat differently, but some coatings always show a high resistance and some always show a low resistance. There is excellent agreement between the bureau's laboratory test of the specimens buried in soil and the field results.

After nine months' exposure some of the coatings, which as a group were the best available, were badly distorted, and some in the highly corrosive soils had failed. The specimens have not yet been examined in the laboratory, but it was evident when they were removed that some of them had completely lost their bond to the pipe, and some of the fabrics were completely rotted.

The laboratory work on the specimens will require several months for its completion, at which time we hope to be able to reach some conclusions.

Corrosion Studies

The work requiring the most time has been the removal and examinations of soil corrosion specimens and the correlation of corrosion data, with data on soil characteristics. At the time this report is being prepared, the work is incomplete, and only a few preliminary results have been obtained. Corrosion data indicate that the 1930 specimens have behaved similarly to those removed previously. No marked differences between different pipe materials are observable, and it is doubtful whether the minor differences observed are caused by differences in material or variations in soil conditions. As noted in the preceding report on this work, there is a tendency for rates of corrosion to decrease, and a still greater decrease in rates of pitting is observable. On account of the variations in the data for the same material, the bureau believes that the results so far obtained are not sufficient to justify comparison of materials. By averaging results of tests of all materials in each soil, more representative data are obtained; and it is believed that these data are now sufficiently reliable to justify their use in the study of methods of determining soil corrosiveness.

Preliminary results of tests started in 1928, to determine whether the same rate of corrosion could be expected throughout soils classified as belonging to the same soil series, indicate that if the rate of corrosion is known at one location in a soil of a given series, that rate may be taken as representative of the corrosion to be expected wherever that soil series is encountered, provided the variation in moisture content of the soils is not too great. This means that the soil maps of the Department of Agriculture can be used for determining the corrosiveness of soils whenever data on the corrosiveness of the soil series are available. As soon as satisfactory correlations between soil characteristics and corrosion have been worked out, all of the soil survey work will be applicable to the determination of corrosiveness of soils along pipe line routes. Distinct progress has been made in this correlation of soil characteristics with corrosion, as is shown elsewhere in this report.

Some preliminary results are available from a series of experiments[1] being conducted with forty-three 24-inch coated nipples buried in boxes of soil. Two of the 43 nipples were removed from their soil boxes after 10 months' exposure to about 25 cycles of wetting and drying. The coatings on these two nipples show the distortion and the type of failure described by Scott and by Fitzgerald as characteristic effects of soil stress. Evidently soil stress of sufficient intensity for the purposes of study may be developed by the small volume of soil contained in a box of less than 1 cubic foot capacity.

At present, all but 10 of the coatings in the soil boxes are permeable to water to such a degree that active corrosion of the pipes might be expected, and the wetting cycles are being continued in the hope that examination of the nipples at the end of the experiment may yield information on corrosion as well as on soil stress.

The progress of the penetration of water into the coatings was followed by measuring the electrical resistance of the coatings at intervals. Twenty-three out of the forty-three coatings had an initial resistance greater than 500 megohms, which is the upper limit on the range of our measuring instruments. Of these 23 coating, 3 still have an electrical resistance greater than 200 megohms, and 5 others greater than 0.5 megohm, after 30 weeks in the soil boxes.

Corrosion in the East

The fact that comparatively few studies of soils in relation to corrosion have been made in the East is to be ascribed to the limited mileage of pipe lines in that section and to the generally moderately corrosive character of eastern soils. The rapid extension eastward of natural gas lines has called attention, however, to the need of more detailed information concerning the corrosiveness of soils, which differ widely in their characteristics from the soils usually encountered in pipe line operation.[2] Although the soils of the East and Middle West are not as a class to be considered severely corrosive, results obtained in the original soil corrosion investigation of the Bureau of Standards have shown that certain soils which occupy extensive areas in the East are but slightly less corrosive than some western soils noted for their corrosive character. Furthermore, the experience of a certain pipe line company in the East has shown that rather extensive replacements of their lines have been necessary in some soils in which there was no obvious cause of corrosion. A study that has been conducted within the past year in Ohio has brought out several important relationships between corrosion and the kinds of soil occurring along the line and certain of the characteristics of these soils. This study has had the further result of leading toward the development of methods for detecting soil corrosiveness.

Method of Study

The particular method adopted in carrying out this study was made possible by the fact that the company operating the lines has kept for many years a detailed record of all leaks and replacements that have occurred on the lines. The actual procedure followed was first to identify the various soils occurring along the lines and to fix their boundaries by stake number. The relation obtained between corrosion and soil series was then studied by plotting the average percentages of

*Presented at eleventh annual meeting, American Petroleum Institute, at Chicago, November 13. Publication approved by the director of the Bureau of Standards (United States Department of Commerce).

[1]This section of the report was prepared by V. H. Gottschalk, who conducted the tests.

[2]This section was prepared by I. A. Denison, who conducted this study.

pipe replaced in 1,000-foot intervals along the lines, indicating on the diagram the boundaries of the soil series present. At a number of locations, soil samples were taken at pipe depth for study in the laboratory of those factors which appeared to influence corrosion.

Comparison of the areas differing in corrosiveness with the areas occupied by the various soils indicated a general relation between soil series and corrosion. It was found that heavy soils which were characteristically acid in the upper subsoil were invariably corrosive along the section of the line studied. Heavy neutral or alkaline soils and areas of sandy soils were relatively noncorrosive. The fact that acidity seemed to be an important factor in the corrosiveness of these soils suggested that a quantitative expression for corrosion would be afforded by determination of the total acidity of the soils. Results of total acidity measurements of nearly 100 samples by a method involving the replacement of hydrogen ions of the soil by the basic ion of a neutral salt solution, and titration of the extract showed that the values for acidity defined the corrosive and noncorrosive areas in a satisfactory manner.

Estimating Corrosive Factors

In the study of soil corrosiveness, particularly in connection with corrosion surveys prior to pipe line construction, it is an advantage to employ methods suitable for the rapid estimation of corrosive factors in the field. It was found that the relation obtaining between the total acidity values of the soils studied and their pH values in normal potassium chloride solution was sufficiently close to permit the use of the latter determination as an alternative method for indicating the corrosiveness of the soils studied.

Soils which are inherently corrosive toward pipe materials might be expected to produce degrees of corrosion in the laboratory which would bear some relation to their corrosiveness in the field. This assumption is the basis of an accelerated test for soil corrosiveness which has been devised by V. A. Grodsky, research associate of the Cast Iron Pipe Research Association at the Bureau of Standards. This test was used in the present investigation in order to obtain additional information on the corrosiveness of the soils under study.

The method consists in determining the extent to which a steel disc, 0.004 inch in thickness, is corroded in moist soil in a period of two weeks. A number of precautions are necessary in carrying out the test, particularly with regard to fixing the quantity of water to be added to the soil in contact with the disc and in maintaining the proper degree of moisture in the soil during the test period. The quantity of moisture added to each soil was given by the moisture equivalent, which is the percentage of water retained by a soil under a force of 1,000 times the force of gravity. The moisture of the soil was maintained at this value by placing the sample, contained in a small glass dish, in a 1-pint preserving jar in which a small amount of water was present. Evaporation was prevented by sealing the jar at the beginning of the test. After two weeks the discs were cleaned, weighed and the losses of weight due to corrosion calculated as percentages of the original weights of the discs.

Comparison of Data

Comparison of the data obtained from the accelerated test with the actual corrosiveness of the soils, as given by the data on pipe replacements, showed that the loss-of-weight values paralleled in a general way the replacement data, except in an area occupied by a certain sandy loam soil. Further investigation showed that this soil, in contrast to the other sandy loams along the line, was underlain at pipe depth by dense, compact, glacial material which, by reason of its impenetrability to water, was an important factor in the corrosiveness of the area.

Additional information concerning the factors inducing corrosiveness along the line was obtained by plotting the data obtained from the accelerated test against the pH values of the soils in potassium chloride. It was found in the case of the heavy soils, viz., the clays and sandy loams, however, corrosion appeared to be but slightly influenced by acidity. The distribution of the points on the curve indicated that loss of weight in soils of intermediate texture, viz., silts and silt loams, is influenced by acidity in proportion to their content of fine soil particles.

The methods that have been discussed for studying the corrosiveness of soils are generally applicable to the soils of the Middle West and eastern parts of the United States, as well as in other areas where rainfall has been sufficient to induce an acid condition of the soil. Further study, however, of the methods given in soils of widely different characteristics would be necessary in order to establish their dependability under different conditions.

Pipe Line Currents and Electrical Resistivity of Earth to Corrosion

As earlier work of the Bureau of Standards and of other investigators indicated that measurable electric currents, probably of galvanic origin, are to be found on practically all pipe lines, it was deemed worth while to extend the scope of the investigation, under conditions which would permit of examining the pipe for corrosion, to see if any relation exists between such corrosion and line currents.[2] Such study was made ex-

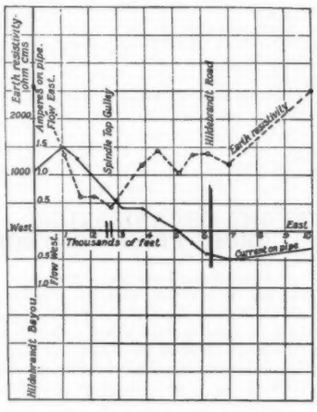


Figure 1—Eight-inch oil line through Spindle Top gulley.

tending over a period of nearly three months beginning April 1, 1930, and including nine pipe lines totaling approximately 60 miles of explored pipe, and ranging in location from the Gulf Coast through Texas and Oklahoma to southern Kansas. The work was carried out through the active co-operation of several large pipe line companies. In selecting a few pipe lines for examination from among a large number that were available, consideration was given to a number of factors, the chief of which was the opportunity for examining corrosion or availability and accuracy of leak record.

Measurements of current flow on pipe lines were made by observing the potential drop on a 75-foot length of pipe with a very sensitive milli-voltmeter. Contacts were made on the line by prodding down to the pipe with a steel bar, then inserting diamond-point drill rods in the holes, and twisting or tapping these until they made good contact with the pipe. Where reconditioning or reclaim work was in progress, measurements were sometimes made after the top of the pipe had been exposed.

Of Galvanic Origin

It was soon evident that the currents observed were largely of galvanic origin. Small variations at any one point were attributed to distant interurban electric lines, but abrupt changes in magnitude from point to point along a line indicated that the currents originated and disappeared at the pipe surface. Currents were found to be flowing in certain sections of a pipe line from both directions. Moreover, these currents remained substantially constant day after day, except for the small stray fluctuations referred to. A more detailed study showed that, as a rule, current accumulated on a pipe gradually over a considerable length and discharged abruptly over relatively short sections of the pipe line.

A study of the soil along the lines, including electrical resistivity measurements, showed that invariably the areas of abrupt discharge were in soils of low resistivity; while the areas of collection or little change were in soils of normal or high resistivity. On some lines it appeared that the soil conductivity was almost a direct measure of the amount of corrosion on the main. Here, then, was a three-way correlation between line currents, soil conductivity, and corrosion. As the work progressed, these relations were found to hold true quite generally; in some instances the correlation was striking, while in others it was less definite. Figures 1 and 2, taken from a more detailed report, are submitted as typical examples of data showing these relations. In examining these figures it should be noted that an ascending slope in the current curve from left to right represents a discharge of current from the pipe, while a descending slope from left to right represents a collection of current. This is true both above and below the base line. It is, of course, also understood that a discharge of current from a pipe is usually accompanied by corrosion, while a collection of current is not.

Spindle Top Gulley

Spindle Top Gulley is well known by the pipe line companies as a region of extremely corrosive soil. The measurements recorded in Figure 1 were made along an 8-inch line which runs through that territory. The correlation between current discharge, soil resistivity, and corrosion is practically perfect. Engineers of the company state that the worst corrosion has occurred between 2,000 and 3,000 feet from Hildebrandt Bayou, as shown in Figure 1. It will be seen that this is also the region of highest current discharge and lowest soil resistivity.

A very satisfactory correlation between current discharge and earth resistivity is shown in Figure 2. Two points of unusually high current discharge are shown at Stations 216 and 221.5, and at both locations the earth resistivity drops to abnormally low values. Both of these points are in corn fields. In the first the corn was yellow and sickly, showing the effect of the clay outcrop. In the other place the corn was green and rank because of sufficient good soil over the clay subsoil. The pipe was uncovered at Station 221.5, and found to be pitted to a depth of 0.15 inch. Many pits

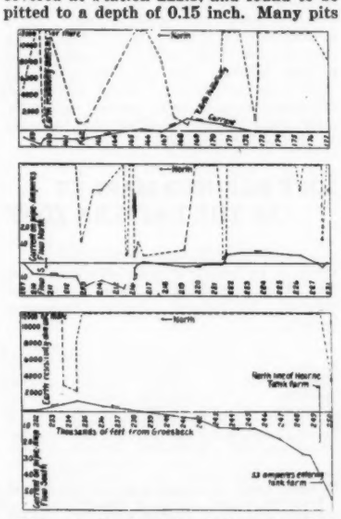


Figure 2—Twelve-inch oil line, Groesbeck to Hearne, Tex., laid in 1923.

0.1 inch deep were found. The low resistance regions at Stations 162 and 168 are also accompanied by loss of current from the pipe line, but the density is relatively small. An inspection at Station 162 revealed no extensive corrosion. The large current of 5.3 amperes on the south end of the line is entering the Hearne tank farm. The collection on the line near the tank farm is very dense, as indicated by the steep slope of the curve.

While it has been generally recognized that the electrical resistivity of earth is one factor in the corrosion problem, its true significance has been so masked by a host of other factors as to make its relation to the problem difficult of analysis. The most corrosive soils, as indicated by the tests of the Bureau of Standards on buried specimens, are in most cases soils of low resistivity. These include the alkali soils of the West, the salt marshes of New Jersey, and the acid soils of the Gulf Coast. Among the soils of higher resistivity no definite relation between resistivity and corrosivity appears to exist. There is also some evidence to show that the critical value may be different in different soils or in different localities, or, in other words, that relative resistivities in any territory may have some significance with respect to corrosion.

A review of the data obtained on long line currents will show that wherever the soil resistivity drops to about 500 ohm-cm., or lower, there is a sharp loss of current and pronounced pitting. Smaller values of current discharge occur in areas where the soil resistivity is 600 to 1,500 ohm-cm.; but as a rule the corrosion in such areas has not been acute. Illustrative of this is Figure 1, where the discharge zone coincides with a soil resistivity of about 1,300 ohm-cm., or lower; but where destructive corrosion has occurred only where the resistivity is 600 ohm-cm., or lower. In other areas, there is a rather sharp line at about 500 ohm-cm., below which practically all of the corrosion trouble experienced has occurred. In only one instance throughout the entire investigation was severe pitting encountered in any but soils of low resistivity.

Where accurate results are desired, it is customary to measure the resistance of earth and other electrolytes with alternating current, in order to avoid polarization and other effects inherent in methods employing direct current. However, by employing a suitable range of current density and voltage, and by taking readings immediately after the circuit is closed or before polarization has set in to any great extent, it is possible in most soils to obtain by direct current measurement results closely approximating the actual resistance of the medium.

Resistance Tests

Because of the extreme simplicity of the direct current equipment and the greater speed with which it can be used in the field, this method was employed in making soil resistance tests in this investigation. Two brass-tipped, oak canes were constructed with the voltmeter mounted on one and a small flashlight battery on the other. These canes are pushed into the earth to any desired depth and a reading is obtained by pressing the voltmeter key. The resistance in ohms between the cane tips is then calculated. To obtain the specific resistivity of the earth, the constant for the apparatus must be known. This constant will depend on the area and shape of the metal electrodes, and can be obtained by calibrating them in a medium of known resistivity. The resistance between the tips of the canes is practically independent of the distance between them, provided it is 6 inches or more.

This apparatus will permit of making frequent and rapid tests of earth resistivity along a pipe line or along a projected pipe line. Although it is not claimed that absolute values of resistivity are obtained with this apparatus, the results will be sufficiently accurate for all practical purposes, provided the soil is not too dry. It is important, therefore, to test the earth at a level where there is sufficient moisture to afford nearly maximum conductivity. Measurements should not be made in dry soil, as they will mean nothing; even though an indication of the voltmeter is obtained. Damp soil which will pack in one's hand will usually show nearly 100 per cent of its maximum conductivity. It is, therefore, necessary to confine measurements to wet, or at least to damp soil. Measurements should be taken at approximately the depth at which the pipe is laid, and consideration should be given to whether the soil is abnormally wet or dry. The

(Continued on Page 228)

[2]This section of the report was prepared by E. R. Shepard, who conducted this investigation.

ROCKY MOUNTAIN AREA

(Continued from Page 209)

is at 4,635 feet and is expected to go to 6,000 feet for a complete test of the Sunburst area in the deeper horizons.

In the Border Field, the Vanalta Oil Co. is making location for a well that will start drilling this fall on the Canadian side of the line. This is one of the 16 wells the Vanalta contracted to put down when the firm entered the field.

Great Falls is to be the meeting place of the Alberta and Montana divisions of the Rocky Mountain Oil and Gas Association this year. The convention will be held December 12 and 13.

Rocky Mountain Production

Average daily runs from fields week ending November 8:

WYOMING	
Salt Creek	28,910
Big Muddy	2,030
Grass Creek	2,140
Elk Basin	810
Dallas	280
Dry Creek	60
Frannie	770
Hudson	270
Lovell	10
Teapot	20
Warm Springs	100
Rock River	2,100
Lance Creek	260
LaBarge	1,810
Poison Spider	390
Oregon Basin	2,560
Osage	1,000
Ferris	13
Byron	510
Lost Soldier	3,130
Simpson Ridge	50
Dutton Creek	50
Total Wyoming	47,290
MONTANA	
Cat Creek	1,080
Lake Basin	60
Kevin-Sunburst	2,540
Pondera	1,680
Border	540
Total Montana	5,900
COLORADO	
Florence	427
Moffat	1,206
Fort Collins	1,115
Iles Dome	1,022
Rangely	50
Tow Creek	341
Boulder	25
Total Colorado	4,184
NEW MEXICO	
Rattlesnake	1,053
Hogback	440
Table Mesa	83
Artesia	814
Cap Rock	503
Getty	138
Hobbs	34,125
Jal	1,411
Lea	3,683
Miscellaneous	1,787
Total New Mexico	44,037
Total Rocky Mountain	101,411
Week ending November 1	103,771
Difference	2,360

CHICAGO MARKET IS A LITTLE STRONGER

(Continued from Page 212)

fications as well, as a los of gas oil that is frankly inferior but these sell quite readily at a little less than 2 cents or at 2 cents. The refiners claim to be holding their prices for U.G.I. gas oil at 2⅛ cents to the trade and of course the large buyers get the same prices if not a little less. The demand is still limited although a little better and many believe that with the coming of longer nights as well as colder weather, there will be a better demand for U.G.I. gas oil from the gas companies.

General Industry Still in Dumps

Heavy industrial fuel oils is still selling in a slow way. There is of course some demand but it is not more than a part of what should be coming to hand at this time of the year. The industrial situation is very spotted. The steel mills are doing around 50 per cent of what they expect for the season. The pig and ingot output is decreasing from week to week. Prices of scrap iron are working lower. There is nothing which indicates a larger business at an early date in the steel industry. Most of the users of fuel oil in the steel industry are so far behind on their contract deliveries that many a contract will never be completed. The auto industry, in spite of the fine showing made, is not gaining at present. Sales of cars show a falling off as do the number of cars registered. The building industry is at present quiet but it is in this industry that the greatest effort will be made to start finding work for the unemployed. Building plans of all sorts will be hastened and road building will be pushed. This class of employment is for the most part out of door work better suited to summer than winter time. Much of the material required can be made in advance under less severe conditions. The trouble is that the wants of the unemployed are a pressing necessity now, and the finding of employment will be delayed if they are obliged to wait for the drafting of plans and specifications and the preparatory work that is necessary in such large jobs, so the demand for fuel that will be required finally to complete these works will be delayed until the beginning of next year at the earliest. The demand is strongly for the zero oils in any gravity. The 18-22 is very hard to find in a zero grade. The price for a zero oil of this gravity in this city is at least 57½ cents and 60 cents has been repeatedly paid by users who wanted a good oil. On the other hand 18-22 gravity oil with a low viscosity and sulphur but a 20 degree cold test is hard to sell here at 45 cents. There is absolutely nothing in the market that is new. The trade is waiting for real cold weather, those who are prepared with the oil to deliver wait with hope while those who are not so well prepared are waiting with some disquietude. They expect some trouble to fill their contracts with the best grade. An early winter with continued snow and cold will certainly see a strong market in this city for all zero fuel and gas oils.

There has been no general change in the tank wagon and station market in this territory. None is expected in the immediate future. The major distributors argue that the motorist is not being overcharged with a price of 17 cents of which 3 cents goes to the State in payment of the gasoline tax. They are also of the opinion that a lower price could not increase the consumption and as all would have the same price, it would not even change the orders from one concern to another. The price cutting continues and from time to time the price is reduced to meet the local competition. There have been no important points at which prices have been reduced this past week unless it be at Detroit where the price is as stated elsewhere, cut to the bone. The selling price to consumers is 8½ cents plus the tax. The price to the distributor is nearly as much. Many of the independent jobbers have closed their stations to wait until the question of a possible price has been settled. Many men have been thrown out of work, much capital now invested is with no prospect of any return. The situation seems to have come to the point where it is mere stubbornness that is in control, not common sense or the good of the industry or of the individuals.

SOFT REFINED MARKET IN THE EASTERN ZONE

(Continued from Page 213)

ports of refined petroleum products from New York for the past three weeks (all figures in gallons unless otherwise noted):

	Week ended		
	Nov. 1	Oct. 25	Oct. 18
Gasoline	125,000	120,000	175,000
Naphtha	360,000	85,000	425,000
Kerosene	7,000	8,000	26,000
Fuel oil	95,000	210,000	230,000
Lubricating oil	1,095,000	1,050,000	1,185,000
Petroleum, ref.	1,280,000	475,000	436,000
	Pounds		
Petrolatum			
Paraffin wax	3,780,000	2,620,000	3,160,000
Refined		205,000	
Scale	245,000	1,150,000	25,000
Lubricating grease	560,000	910,000	650,000

The sharp increase in exports of petroleum, refined, for the week ended November 1 was due to a cargo of 900,000 gallons which went out on the "Leverbank" for Hongkong.

Widespread cuts in crude oil prices during the past fortnight are responsible in large measure for the current lack of export business in refined products, while rumors of impending price cuts in posted prices for gasoline and kerosene in the Gulf export market have also been instrumental in slowing down trade. Numerous revisions in refined products quotations for export are looked for as a result of the lower crude oil basis now ruling in the Mid-Continent and Gulf areas.

Imports

Imports of crude and refined petroleum at the principal United States ports for the week ended November 1 totaled 1,679,000 bbls., a daily average of 239,857 bbls., compared with 1,815,000 bbls., a daily average of 259,285 bbls. for the week ended October 25. Details follow:

	Bbls. of 42 gals.
At Atlantic Coast ports—	
Boston	68,000
New York	983,000
Philadelphia	275,000
Others	132,000
Total	1,458,000
Daily average	208,286
At Gulf Coast ports—	
New Orleans and Baton Rouge	135,000
Port Arthur and Sabine district	86,000
Total	221,000
Daily average	31,571
At Atlantic and Gulf Coast ports—	
Total	1,679,000
Daily average	239,857

Distribution of total imports is as follows:

Crude	1,064,000
Gasoline	235,000
Gas oil	129,000
Fuel oil	251,000

EXPORT ORGANIZATION DROPS PRICE CONTROL

(Continued from Page 216)

expansion was either wise or necessary.

As a result of the failure of the organization to take in the rank and file of the industry, and of the apparent policy of silence regarding the association and its operations, opposition grew up among the independent companies, particularly in the Mid-Continent.

Even though member companies of the export group entered the open market in the Mid-Continent from time to time and purchased large quantities of surplus gasolines for export, this action failed to gain the co-operation of nonmember companies in maintaining posted levels, and offerings by "outside" refiners at concessions of a quarter to three-quarters cent per gallon under association posted prices were common during that group's nominal control over the export price basis.

Lowered Posted Prices

A few months ago, recognizing the difficulties which member companies were encountering in meeting this cut-price competition, the Export association lowered its posted prices on gasoline and kerosene at the Gulf, and at the same time authorized member companies to go below the revised price levels whenever it was found necessary to meet competition under certain specified conditions. This latter concession, it was felt at the time, sounded the death knell of the influence of the Export association, and reports of its pending break-up have been rife since that time, culminating in announcement of the cancelling of all export quotations.

At a meeting of the association held a fortnight ago, a number of members pressed strongly for a reduction of a half cent in posted prices at the Gulf. Unanimous consent to the reduction could not be obtained, it is understood, and as 100 per cent affirmation of all price changes was necessary under the association's plan of operation, the change was not made. Foreign operators, however, were evidently fully informed as to the probability of a price break, as inquiries which had been in the market prior to the meeting in question were withdrawn, and are now coming back into the market at the lower prices now prevalent at the Gulf.

While leading oil companies, including some prominent in the association's operations, are said to feel that the relaxing of price control by the export group will work for the betterment of the market, the action of the Export association's retirement as a price maker is expected to exert a profound influence upon world markets.

Free Rein in Competition

The withdrawal of the export group as price makers, it is felt, will give the larger American companies free rein in meeting the increasingly sharp competition which has developed from Rumanian and Russian sources during the past year, and it is probable that large quantities of surplus refined products will be moved into export channels "at a price." This will materially relieve pressure on domestic markets, it is felt, as well as restore the prestige of American companies which had been losing ground in their export operations through the control which the Export association had exercised over their price schedules.

Several large companies identified with the Export association are understood to have outstanding with Mid-Continent refiners contracts for export grades of gasoline at prices based on the posted association schedule for Gulf shipment. It is understood, however, that these contracts carry subordinate clauses providing for adjustment in the event of a revision in the Gulf price basis.

Present member of the association include Standard Oil Export Co. (Standard Oil Co. of New Jersey); Atlantic Refining Co., Cities Service Co., Continental Oil Co., Gulf Oil Co., Pure Oil Co., Richfield Oil Co. of California, Shell Oil Corp., Shell Union Oil Co., Sinclair Consolidated Oil Corp., Standard Oil Co. of California, Standard Oil Co. of Indiana, The Texas Company, Tide Water Associated Oil Co., Union Oil Co. of California, and Vacuum Oil Co.

Unofficial reports are to the effect that the association will continue in existence up to December 31, this year, at which time it will be dissolved.

LISTS UNITS INSTALLED AT SCATTERED POINTS

(Continued from Page 216)

deposits, has led to the ordering recently of several Dubbs units to operate overseas. Following are the foreign companies which presently are building Dubbs cracking units, with the capacity and the principal stock on which each is intended to operate:

Societe des Raffineries de Petroles de la Gironde, Bordeaux, France. One unit, 2,500 bbls. per day capacity. Will be used to crack different stocks as the needs of the situation demand.

Distillazione Italiana Combustibili, S.A. ("Dicsa"), Venice, Italy. One unit, 750 bbls. capacity, Russian or Rumanian fuel oil, 22-26 A.P.I. gravity.

A. Johnson & Co., Nynashamn, Sweden. One unit, 750 bbls. per day capacity; charging stock, West Texas or Venezuelan fuel oil.

Refineria de Petroleo "La Isaura" Sociedad Anonima, Bahia Blanca, Argentina, S.A. One unit, 750 bbls. per day capacity; charging stock, 21.7° Be. reduced crude or 27.1° Be. topped crude, probably from the Argentine fields.

Diadema Argentina Sociedad Anonima de Petroleo, Buenos Aires, Argentina, S.A. Four units, 2,000 bbls. per day capacity each. Charging stock from Argentine crude.

Assam Oil Co., Ltd., Digboi, Assam, India. Two units, 750 bbls. per day capacity each. Charging stock 10 A.P.I. gravity residual oil from India crude.

CALIFORNIA CRUDE OIL PRICES

(Continued from Page 219)

Column 5—Price change posted by Standard of California September 16.
Column 6—Oil below 14 gravity posted at 45 cents.
Column 8—Posted by General Petroleum Co.
Kettleman Hills—Union Oil Co., September 22, 35 to 39 gravity, $1.10; 40 to 44 gravity, $1.20; 45 to 49 gravity, $1.35; 50 to 54 gravity, $1.50; 55 gravity and above, $1.65. Standard Oil Co. of California, 55 gravity and above, $1.65.

ANTITRUST LAWS ARE DISCUSSED BY DONOVAN

(Continued from Page 51)

to review the present conditions in the industry which gives rise to the emergency. These are conditions with which you are familiar. In discussing the legality of a plan to limit production, it is assumed that production will not be curtailed below even the approximate anticipated annual needs of the public. The legality of such a plan is dependent upon the existence of certain facts, such as a production far in excess of normal and reasonable market requirements with resultant depression in price which threatens to destroy the investment in the industry, and the creation of excess stocks with economic waste and danger due to unnecessary storage above ground.

It was never intended by the Sherman law nor by the courts' interpretation of that law that American industry should be compelled to proceed with a policy of competition that results in self-destruction. As was said in effect by the Supreme Court in a case discussing the rule of reason such a construction of the Sherman act would prevent reasonable agreements among producers to put an end to abnormal and ruinous competition (Standard Oil Co. v. U.S., 221 U.S. 1). It was not intended to destroy but to protect business; not to cause bankruptcy, but to prevent it; not to place the weak at the mercy of the strong, but to give equal opportunity for all to survive.

Sherman Law Interpreted

The Sherman act condemns only such agreements as unreasonably restrain trade. Certain types of agreements, however, are in and of themselves unreasonable without regard to surrounding circumstances. For example, an agreement to fix prices has been held to be illegal whether the prices fixed were reasonable or unreasonable. United States v. Trenton Potteries Co., 273 U.S. 392. In other cases it has been held that an agreement by those dominating an industry imposing conditions upon an individual's right to engage in interstate commerce, or boycotting any person, is illegal regardless of the reasonableness of the conditions imposed upon the individual or the justification for the boycott (U.S. v. Paramount Famous Lasky Corp., 34 Fed. 2nd 984; Eastern States Retail Lumber Assn. v. U.S., 234 U.S. 600). Such agreements are immediately concerned with interstate commerce and are therefore direct restraints of that commerce.

Production Not Commerce

Where an agreement is not itself concerned with commerce it cannot be said to violate the Sherman act in and of itself. In such cases the question of legality depends upon whether the direct or intended effect is to restrain commerce. The intent is determined in view of all the circumstances surrounding the agreement. The Supreme Court has always recognized the distinction between production and commerce and has held that production is not commerce. Therefore the production of petroleum within a state is not interstate commerce (United Mine Workers v. Coronado, 259 U.S. 344). This rule has been reaffirmed in subsequent cases. The case of United Leather Works Union v. Herkert Meisel, 265 U.S. 457, involved a strike by the defendant labor union at the plant of the Herkert & Meisel Trunk Co. It was argued that since the products of the company were destined to be shipped in interstate commerce, that, therefore, the strike of the trade union was a direct obstruction of interstate commerce and in violation of the antitrust laws.

The Supreme Court rejected this view. In its opinion it reviewed many of the earlier cases and concluded this review by stating that:

"It is only when the intent or necessary effect upon such commerce in the article is to enable those preventing the manufacture to monopolize the supply, control its price or discriminate as between its would-be purchasers, that the unlawful interference with its manufacture can be said directly to burden interstate commerce." (At page 471.)

The court in that case referred to the case of United States v. E. C. Knight Co., 156 U.S. 1, which involved a virtual monopoly of the manufacture of sugar. There was no proof, however, of an intent to monopolize or restrain interstate commerce in sugar. The proof only showed acquisitions of stock in sugar manufacturing companies to control its making. While it has been said by the Supreme Court that this case is close to the line, it is interesting to note that the court did not find any necessary restraint upon interstate commerce in the control of supply, but called for positive allegations and proof of the probable relation between the monopoly of manufacture, and the control of sales in interstate commerce.

Need Stable Production

No doubt the most crucial question is as to the effect of such an agreement upon prices. The consumer of your products must bear all the costs involved in the production, manufacture and marketing of the product. In periods of overproduction followed by depression in price, the consumer enjoys a temporary cheapness. However, the investments in the oil business are enormous, and if they are to continue, there must be, as in every industry, a reasonable return upon the capital invested. Consequently, when the emergency is past and normal conditions are again restored, the consumer must make up in higher prices for the temporary cheapness which he enjoyed. Therefore, it would seem to be in the public interest to maintain a stable production which will result at all times in a reasonable return upon the capital invested in the industry and prevent so far as practicable the needless waste of an essential national resource. It would seem that if such an agreement were made in good faith for the purpose of maintaining a stable condition and for the purpose of overcoming the business disasters and depressions which come from periods of excessive production, and is in good faith confined to those purposes a very persuasive argument is offered the court for holding that the effect upon prices charged in transactions in interstate commerce is indirect and remote, and that the agreement does not fall within the prohibitions of the antitrust laws.

Legality of Agreement

In other words, the effect of these decisions is that so far as production is concerned the legality of any agreement must be determined by its purpose and effect as disclosed by the surrounding facts and circumstances. However, the legality of any such plan is conditioned upon the fact that the agreement is voluntary on the part of all concerned and that no coercion is exercised either to make people enter the agreement or to compel its observance. If this is true, then to determine whether such an agreement violates the law the so-called rule of reason will be applied. In this respect the test of legality differs from the test applied to agreements to fix a price or boycott, which, as I have said, are in and of themselves illegal.

This is a frank argument in support of the position that an agreement to limit production in this industry, confronted by a critical emergency, may under proper conditions be justified under the antitrust laws. There may be novelty in this suggestion.

However, under the circumstances I have described, I do not think that the legality of such a plan can be said to have been finally determined. In the light of the decisions of the supreme court interpreting the law, it is in my opinion still an open question whether or not some effective solution of the problem may be had which will not be found to be in violation of the antitrust laws.

Government Should Clear Issue

Because of the natural fears of certain individual companies in this industry due to unfortunate experiences with the Government, any such plan may be regarded as too daring. It seems to me, however, that in these times industry is confronted with a test of its ability not only to regulate itself but also to do those things which may ultimately be for its interests and the interests of the public. That not only requires intelligence in determining what these interests are but the courage to put that plan to the test of court decision. This does not involve the question of a particular company or a group of companies doing something that may be an evasion of the law—this is a question which involves the stability of an entire industry. And in such a situation it would seem that an industry might with propriety claim the privilege of going to its Government to see if an issue can be defined between them for the determination of what can be done to preserve that industry. I know that it may seem less difficult for one who is not directly concerned to suggest this view but I speak with no hesitancy on this subject. The views I now hold are the same views I held as a public official charged with a definite responsibility in the enforcement of these laws.

The administration of the antitrust laws, which represent an economic policy, should not be based on a narrow view but on a broad conception that regards the purpose which the law was designed to serve, and the evils it was meant to overcome. And that purpose was not to shackle industry in dealing with a problem that vitally concerns the welfare of the public, and of the industry itself.

Motion Picture Case

Let me illustrate what I mean. When I was in the government, the motion picture people came to the department. They presented this situation. They said that prior to 1922 they had been faced with thousands of suits involving questions under their exhibition contracts. They pointed out that the speedy determination of these suits was essential because the value of motion picture films decreased rapidly with age. Faced with this situation, producers and distributors distributing annually about 98 per cent of the motion picture films distributed in the United States, prepared a standard form of exhibition contract containing a clause requiring the compulsory aribtration of all disputes arising under the contract. Producers agreed that they would use only this form of contract. They adopted this contract with the knowledge that the legality of the agreement had never been specifically passed upon by the courts. They faced an emergency, just as you now face an emergency, in which they felt that a determination of their rights was essential. They asked what the attitude of the Department of Justice would be.

They were told that it was a case in which the department could not give its sanction but that it was a question that should be passed upon by the courts. The leaders of that industry stated that while they felt that the agreement was legal, they welcomed a case which would definitely outline what could actually be done by their industry under the law. Accordingly, in 1928, proceedings in equity were commenced by the Government. The case has already been argued before the supreme court and is now awaiting final determination. It may be that the legal position taken by the motion picture industry was wrong. Nevertheless, the result of the suit will determine once and for all whether or not their particular method of self regulation is legal or illegal. This indicates a way that can be followed by any other industry in the country. Such decisions of the supreme court will serve the purpose of clarifying for industry the law under which it must operate.

I understand that there may be some hesitation on the part of this industry following such a course because of its experiences in relation to a plan of curtailment embodied in a resolution of a committee of your Institute in March of last year. This agreement was submitted to the Federal Oil Conservation Board for the purpose of securing its approval. The chairman of that board, the Secretary of the Interior, submitted to the Attorney General the question as to whether or not the board had authority to approve a proposed plan and agreement for curtailment of production of crude oil and the Attorney General responded that the board had no authority to grant to any persons immunity from the operation of acts of Congress prohibiting agreements in restraint of interstate commerce and that no action taken by the board could have the effect of relieving parties to such an agreement from the operation of the antitrust laws.

As I read his opinion, that was all that the attorney general decided. Certainly the conservation board created by executive order of the President for the purpose of studying the problem of conservation had no authority to grant immunity under the antitrust laws. I simply wish to point out the fact that it does not appear from his opinion that he passed upon, nor did he undertake to pass upon, the question that we have discussed here and as I understand it there is nothing in that opinion which would preclude this industry from submitting this question to the Department of Justice.

Of course, the industry would submit its plan to the attorney general, not for the purpose of obtaining immunity, but for the purpose of presenting the facts to the Department of Justice and if necessary joining with it in stating a legal issue for submission to the judgment of the court and securing a decision as to what the industry could, or could not do in these particular circumstances under the law. It would be unfair to the Department of Justice and to the attorney general to assume that they have closed the door in the face of any industry that desires within the law to have its rights determined. No one has the right to undertake to anticipate what the decision of the attorney general would be.

What Attorney General Did

My only point is to clear up in the minds of the leaders of this industry what the attorney general by his opinion of March, 1929, in relation to the Federal Oil Conservation Board decided, or undertook to decide. He did not decide that such an agreement as is discussed here was in and of itself illegal. It would be unfortunate if such a misunderstanding of the attorney general's opinion were continued to the extent of precluding your industry working out directly with the department the problems which frankly are raised by your desired plans of conservation in relation to the antitrust laws.

In 1890 and in years immediately following, proceedings under the Sherman law were directed toward specific combinations and monopolies which were the results of agreements and understandings. This method of combination has been abandoned and during the last 20 years we have seen corporate enterprise attain its growth through consolidation and merger. Some may say that this growth has been reached in spite of the Sherman law and in response to the need of mass production to meet the demands of national markets. The existence of the Sherman law has not prevented that growth, but on the contrary, the Supreme Court has held that the law does not make the mere size of a corporation, however impressive, nor the existence of unexerted power on its part an offense when unaccompanied by unlawful conduct in the exercise of that power. It is only when these consolidations either have the intent to monopolize or monopoly follows as a direct and necessary consequence of their organization and practices that they meet the condemnation of the law. Within the spirit of those decisions, it is clear that the Sherman law is resilient enough to be responsive to changing economic and social conditions. It should not be the purpose of that law to deprive men of the right to exercise intelligence in the conduct of their business. If that flexibility does not exist and as a result the stability of your industry as well as that of other industries is threatened then it will be time to consider the question of modifying or abandoning the theory upon which the Sherman law is based. But, first, it would seem only common sense that this industry be certain that under existing law it cannot carry out those measures it believes necessary for its own preservation and its service to the public.

RUSK COUNTY CONDITIONS PUZZLE OPERATORS IN NEW TEXAS AREA

By L. E. Bredberg
Fort Worth Bureau, The Oil and Gas Journal

FORT WORTH, Tex., Nov. 10.—Arkansas Fuel Oil Co.'s No. 1 Worrell, a short distance southeast of the Joiner discovery in the Juan Ximenes Survey, central Rusk County, is now shut down at 3,600 feet after cementing casing on November 8, offering itself as an enigma to operators and threatening to become a dry hole, cutting off hope of production in that direction from the discovery well. A fault between the two may be established as a fact and the field extended to the southeast when the well is drilled deeper. The Joiner well topped the pay and is producing from 3,594 feet, and the formation from 3,548-58 feet in the Arkansas Fuel Oil Co.'s test seems to check closely with the Joiner pay. Only a foot of saturated sand was found in the Arkansas test from 3,547-48 feet when the test was cored, and a core from 3,570-80 feet showed shale with streaks of sand, and from 3,580-90 feet showed shale with little sand, with all shale showing from 3,590-3,600 feet, being shut down at the latter depth to test the foot of saturated sand from 3,547-48 feet. It will be tested within the next two or three days.

If this well does not prove a producer it will dampen the hopes of operators and companies who own acreage to the east of the Joiner discovery, and will cause some fear to those who are drilling in other directions from the discovery, although many have felt that the Joiner well was on the east flank of the structure and that wells located to the west would strike greater production, and that the pool would run to the west.

H. L. Hunt's No. 1 Bradford in the Ximenes Survey, south of the Joiner discovery, is drilling below 2,600 feet and will soon be down at a critical depth telling whether or not production will be found to the south. As it is a south offset it should be sure of producing if any other wells are to be brought in in this area, and the question remains as to how large a well it might make.

Frank Foster and Deep Rock Oil Co.'s No. 1 Ashby is another test in the Joiner Pool which should tell something within a few more days, as it is drilling around 2,700 feet. It is located 1,204 feet from the west and 595 feet from the north line of the C. D. Ashby 75-acre tract in the Ximenes Survey.

Lauren L. Smith's No. 1 W. H. Worrell in the Ximenes Survey, north of the Joiner discovery, is another test which is down near a critical depth, drilling below 3,120 feet.

Casing will be cemented in these three important tests around the Joiner discovery and the plugs drilled, and wells tested before anything definite will be known in regard to further production and possibilities of the Joiner Pool, and the next 10 days will be especially interesting when the tests are made pointing to failure of the various tests or their success, limiting the pool or extending it as the case may be.

Many geologists held the opinion that this area is too far east in the basin to bring forth much production from the Woodbine sand, and unless these new tests come in producers this belief will gain converts. As it now stands, very little can be said definitely in regard to possibilities of the area. Testing the wells will soon tell a definite story, and the pool may be given a big boost starting renewed activities, or become dormant, as the case may be.

In Van Zandt County

Another well in the north end of the Van Field is proving out as a dry hole, aiding in establishing a limit to production in that direction. This is Pure Oil Co.'s No. 1 A. G. Tunnell, located in the NE cor. of a 50-acre tract in the Mund Gross Survey. A late report on the test shows it drilling below 3,226 feet in sandy shale, without much hopes of making a producer.

Drawing a line straight through this potential failure, to the southwest down through Pure Oil Co.'s No. 1 A. Crim, in the SE cor. of a 48.5-acre farm, which was abandoned as dry at 3,594 feet, and on down midway between Pure Oil Co.'s No. 1 Petty in the SE cor. of a 101.7-acre tract, and Pure Oil Co.'s No. 1 I. W. Thompson, due west in a 95-acre tract of the Mund Gross Survey, which is coring at 3,138 feet, we may obtain an apparently definite border on the western side of the field, limiting production to that line.

Another line may be drawn on the southeastern side of the field from the dry hole of the Humble Oil & Refining Co. on the 20-acre J. A. Freeman farm in the John Walling Survey, down through Kraft & Kelsey's No. 1 Enas in the J. Prado Survey, which will probably be abandoned at 2,973 feet after testing mud and salt water. These two lines narrow the width of the producing area to less than 2 miles.

The field has not been defined to the south, but has been limited to the north, and 13,000 feet is the extent of acreage which has been proven for production in this trend. The Carroll district has been defined to the northeast, but may be extended on acreage which lays to the east.

Humble's Tank Farm

The Humble Oil & Refining Co. is now clearing ground for its tank farm, pumping station and camp on the Ruth Starr Blake 201.4-acre farm in the John Walling Survey, where the western end of its 10-inch line from the Van Field to Louisiana will take on crude from the field for the Standard Oil Co. of New Jersey's refinery at Baton Rouge, La. Work on the camp and tank farm and station will commence within a few days, and just as soon as the ground is cleared. The line is being welded and laid out of Longview and Waskom, Tex., and is being rushed in order to prevent inclement weather from retarding progress.

East Central Texas Production

Daily average production of the pools in the East Central Texas area for the week ending November 8 follows:

Boggy Creek	3,015
Cedar Creek	45
Currie	300
Hill County	30
Mexia	3,971
Minerva	545
Nigger Creek	170
Powell	5,486
Richland	170
Thrall	40
Van	27,818
Wortham	630
Rusk County	248
Total	42,468
Week ending November 1	41,808
Increase	660

COMPLETIONS IN EAST CENTRAL TEXAS

Anderson County

Humble Oil & Refining Co.'s No. 4 Tom Jones, initial production 1,400 bbls. of fluid, first 24 hours, of which 480 bbls. was oil. Total depth 3,487 feet.

Kaufman County

Shaw and Alexander's No. 1 Barrown, dry and abandoned. Total depth 3,518 feet.

Van Zandt County

Pure Oil Co.'s No. 2 A. G. Maxfield, initial production, estimated 100 bbls. on the first 24-hour gauge. Total depth 2,956 feet. Pure Oil Co.'s No. 1 Free Methodist Church lot, initial production estimated at 120 bbls. on first 24-hour gauge. Total depth 2,933 feet. Pure Oil Co.'s No. 2 O. L. and L. L. Swain, initial production estimated at 90 bbls. the first 24-hour gauge. Total depth 2,952 feet.

TRET-O-LITE OFFICIAL DEAD

Major E. O. Sanguinet, vice president and sales manager of W. S. Barnickel & Co., manufacturer of Tret-o-lite, died in his home in St. Louis, Mo., and funeral services were held Thursday of last week. Major Sanguinet was associated with the late W. S. Barnickel in perfecting the Tret-o-lite process of removing water and b.s. from crude oil.

EAST CENTRAL TEXAS WILDCATS

Week Ending November 10

CHEROKEE COUNTY

Arkansas Fuel Oil Co.'s No. 1 Deaton, 330 ft. from S line, 300 ft. from E line, from 160-ac. tract in F. Calmen Heirs Sur., 3 miles SE of Jacksonville ..... Drlg. 3,615 ft.

DELTA COUNTY

D. S. Hood's No. 1 J. J. Balser, 185 feet from S and 580 feet W of Balser 40-acre tract in SE cor. T. B. Laddin Sur. ..... Moving in material.
Worthington and Stedman's No. 1 W. H. Dejchett, 150 ft. from S and 776 ft. from W of 52-ac. tract, E. Clark Sur. ..... Rig up.

FANNIN COUNTY

E. A. Parsons et al's No. 1 Morgan in the English Sur., 3 miles NE of Savoy ..... Fishing 3,420 ft.
E. M. Rogers' No. 1 McSwain, 300 ft. S and E of Michael Daly Sur., in Juana Telgado Sur., 1½ miles NE of Lomasco ..... Shut down 1,500 ft.

GREGG COUNTY

M. S. Hammond's No. 1 J. M. Hamby, 2?8 ft. from E line, 1,667 ft. S of Hamby 3,800-ac. tract, Martin Lant Sur. ..... Drlg. 2,588 ft.
J. C. Ferrell's No. 1 J. K. Lathrop, 661 feet from N and 1,194 feet from W of 96-acre tract, William Robinson Sur. ..... Derrick.

HENDERSON COUNTY

H. E. Ashburn et al's No. 1 T. E. Barry, center of Barry's 59-ac. tract in A. York Sur. ..... Drlg. 3,221 ft.
E. L. Chapman's No. 1 Cade, 1,662 ft. from N and 3,354 ft. from W of No. 1, J. B. Dorsey Sur. ..... Shut down 944 ft.
Texas State Oil Co.'s No. 1 Skinner, 150 ft. from E and 150 ft. from S. J. Henshaw Sur. ..... Drlg. 3,585 ft.

HUNT COUNTY

Branson et al's No. 1 West, 350 ft. N, 350 ft. W of W 60-ac. tract, Jas. Rooces Sur. ..... Shut down 3,294 ft.
Mamie S. Hammond's No. 1 W. H. Adams, center of survey, west of Branson Sur., J. A. McFarland Sur. .... Derrick blew down.

LAMAR COUNTY

Everett & Allen's No. 1 Guest, 250 ft. S and 2,046 ft. E of 100-ac. tract, L. Roberts Sur. ..... Spudded and shut down.

NAVARRO COUNTY

Young et al's No. 1 Farmer, 700 ft. from S and 400 ft. from E of 110-ac. farm in Finley Sur. ..... Shut down 960 ft.

POLK COUNTY

Sunshine Oil Co.'s No. 1 J. A. Collins, 313 ft. from NE 150 ft. from SE at right angles to line, A. Viesca Sur. Shut down 8,000 ft.

RAINS COUNTY

Everett & Morrison's No. 1 Franklin, 640 ft. from S and E of 75-ac. tract in John Christian Sur., 6 miles SE of Emory ..... Spudded and shut down.

RED RIVER COUNTY

Buffington et al's No. 1 L. H. Moore, 160 ft. from S and 160 ft. from W of 100 acres, Daniel Cornelius Sur. ..... Material (rotary test).

RUSK COUNTY

Stroube and Stroube's No. 1 H. Frederick, 156 ft. from N and 500 ft. from W of SE of Frederick 195 acres, Juan Ximenes Sur. ..... Drlg. 2,236 ft; elevation 4,152 ft.
E. L. Chapman's No. 1 A. P. Finney, 150 ft. from W of E 20 acres of 102-ac. tract, Isaac G. Parker Sur. ..... Location.
Dan Dillon et al's No. 1 W. H. Frederick (Jake), 150 ft. from E and 150 ft. from S of 50-ac. tract, Juan Ximenes Sur. ..... Rotary rig.
Goodman's No. 1 Oscar Jones, 250 ft. from W and 150 ft. from N of railroad, Brown Sur. ..... Moving in material for rotary rig.
Omaria Meredith's No. 1 Robertson, 150 ft. N along W line of George Guthrie Sur. from SE cor. and 150 ft. W of E line of Robertson 20-ac. tract, R. H. Pinney Sur. ..... Derrick (rotary).
A. A. Malone's No. 1 William Camp, 150 ft. from E and 150 ft. from S, Juan Ximenes Sur. ..... Location.
Arkansas Fuel Oil Co.'s No. 1 J. A. Worrell, 7,361 ft. from N and 5,361 ft. from E, Juan Ximenes Sur. .... Oil sand 3,547-57 ft.; preparing to set csg.; now reaming 3,600 ft.
Frank Foster et al's No. 1 Ashby, 200 ft. from N and 250 ft. from E of 75-ac. tract, Juan Ximenes Sur. .... Drlg. 1,650 ft.
Alford et al's No. 1 W. L. Thrash, 1,103 ft. from N and 420 ft. from E of SE cor. of B. Smith Sur. ..... Derrick.
C. M. Joiner's No. 3 Bradford, Juan Ximenes Sur. ..... Flowed 226 bbls. through 2½-in. tube.
Mass et al's No. 1 Matthews, 3,244 ft. from N, 4,356 ft. from E, Dalines Cartinas Sur. ..... Derrick down.
Rosenfield's No. 1 L. A. Pinkston, 150 ft. from N and 262 ft. from W of Pinkston 77-ac. tract, Maria V. Pena Sur. ..... Shut down 2,015 ft.
Anderson et al's No. 1 G. T. Moore, 600 ft. from E along S line of G. T. Moore 100 acres and 580 ft. from S line of tract, Juan Ximenes Sur. ..... Location.
Anderson et al's No. 1 Bradford, 150 ft. from N and 150 ft. from E of lot No. 2, Juan Ximenes Sur. Drlg. 1,045 ft.
Lauren L. Smith's No. 1 W. H. Worrell, 333 ft. from N and 6,442 ft. from E of Juan Ximenes Sur. ..... Drlg. 3,113 ft.
Tex-Lloyd Oil Co.'s No. 1 Camp, 150 ft. from E and 150 ft. S of 5-ac. tract, Juan Ximenes Sur. ..... Drlg. 802 ft.; elev. 408.4 ft.; (rotary).
L. H. Hunt's No. 1 Bradford, 1,269 ft. W and 1,083 ft. S of SW cor. of J. T. Moore's 100 acres, Juan Ximenes Sur. ..... Drlg. 2,591 ft.
Bateman et al's No. 1 Lois Della Crim, 3,088 ft. W along N line of survey of NE cor. and 400 ft. S at right angles to N line of survey, E. G. Serlen Sur. ..... Shut down 450 ft.

SMITH COUNTY

Owens & Sloan Oil Co.'s No. 1 Stearns, 846 ft. along W lines of John Waller Sur. from NE cor. of J. O. Dillard Sur., and 80 ft. E at right angles to W line of J. Waller Sur. ..... Fishing 3,370 ft.
Sun Oil Co.'s No. 1 D. McGehee, 500 ft. W and 250 ft. S of SW cor. of Mrs. Julia Phillips 55-ac. tract, Thomas Quevado Sur. ..... Cored sand 2,015-23 ft.
Thayer & Rogers' No. 1 Willingham, 150 ft. N and W of 14.5-ac. tract, Jacob Hernin Sur. ..... Drlg. 1,825 ft.
Winona O. & G. Co.'s No. 1 Freeman, 150 ft. from S. W of 89-ac. tract in A. J. Legrone Sur., 4 miles SE of Winona ..... Shut down 3,509 ft.

TITUS COUNTY

Deep Rock Oil Co.'s No. 1 Ed McElroy, C of 100 acres, K. Lewis Sur. ..... Rigging up.

VAN ZANDT COUNTY

L. R. Barton's No. 1 Wamble, 300 ft. from S and W of 100-ac. tract in Pleasant Young Sur. ..... Derrick.
D. H. Byrd's No. 1 W. H. Mawes, 150 ft. from S and 150 ft. from W. J. Piles Sur. ..... Drlg. 4,700 ft.
Cranfill & Germany's No. 1 Swain, 137 ft. N and 50 ft. from W of excess strip on W side of O. L. and L. L. Swain farm ..... Shut down 14 ft.
T. Daniels' No. 1 Fannie Cumbine, 185 ft. S and 175 ft. E of NW cor. 156-ac. tract, John Wright Sur. ..... Temporarily abnd.
Dennis Oil Co.'s No. 1 C. W. Morris, 100 ft. from N and 300 ft. from E lines of Morris 160-ac. tract in C. L. Morris Sur., 5 miles SE of Ben Wheeler ..... Temporarily abnd.
Hartt Oil Co.'s No. 1 Dr. L. M. Cox and A. C. Night Sur., 1,786 ft. N of S line and 524 ft. E of W line .... Shut down 200 ft.
Humble Oil & Ref. Co.'s No. 1 A. J. Fowler, 150 ft. from S and E of farm, John Walling Sur. ..... Set 410 ft. of 10-in. csg.

Humble Oil & Ref. Co.'s No. 5 R. S. Blake, 150 ft. from N and 150 feet from E of SW cor. of Mrs. E. E. Carroll farm, John Walling Sur. ....Location.
Humble Oil & Ref. Co.'s No. 6 R. S. Blake, 150 ft. from N and 150 ft. from W of SW cor. of Mrs. E. E. Carroll farm, elevation 485 ft.; John Walling Sur. ....Location.
J. C. Fare's No. 1 P. S. Hand, C of Hand's 50-ac. tract, William Shuman Sur. ....Moving in machine.
Humble Oil & Ref. Co.'s No. 2 Sanger, 506 ft. from N and 200 ft. from W, John Walling Sur. ....Spudded.
Pure Oil Co.'s No. 2 A. W. Ellison, 200 ft. N of S line and 225 ft. W of E line of lease, James Rase Sur. ....Cement setting 307 ft.
Pure Oil Co.'s No. 2 A. D. Clark, 380 ft. NW of S cor. of Mund Gross Sur., and 170 ft. SW of NW line of lease in J. Prado Sur. ....Location.
Pure Oil Co.'s No. 4 N. E. Clark, 109 ft. W of W line of A. D. Clark 17-ac. lease, and 645 ft. S of N line, A. H. Wiley Sur. ....Location.
Pure Oil Co.'s No. 2 F. B. Smith, 139 ft. E of W line and 157 ft. N of S line of lease, in John Walling Sur. ....Location.
Pure Oil Co.'s No. 2 A. D. Clark, 203 ft. from N of S line and 110 ft. W of E line of lease, John Walling Sur. ....Derrick completed.
Pure Oil Co.'s No. 2 J. T. Taylor, 202 ft. from W of E line and 150 ft. from S of N line, John Walling Sur. ....Reaming crooked hole 380 ft.
Pure Oil Co.'s No. 1 L. A. Smith, 150 ft. from N of S line and 139 ft. W of E line of lease, John Walling Sur. ....Drlg. 2,150 ft.
Pure Oil Co.'s No. 1 R. D. Clark 42 acres, 200 ft. S of N line and 150 ft. E of W line, A. H. Wiley Sur. ....Preparing to drill plug.
H. Helms et al's No. 1 Bogue, 647 ft. W and 155 ft. S of SE cor. of J. M. Brown 70-ac. in Marshall University Sur., SE of Van ....Shut down 2,212 ft.
B. P. Hervey's No. 1 Foster & Smith, 150 ft. S and 150 ft. W of 104-ac. tract, Margaret Neal Sur. ....Shut down 4,601 ft.
Howard & Dooley's No. 1 Elliott 188-ac. tract in W. H. Bundy Sur. ....Derrick.
Humble Oil & Ref. Co.'s No. 1 L. A. Dowdle, 1,027 ft. N of S line and 150 ft. E of W line, William Daniel Sur. ..Temp. abnd. 2,987 ft.
Imperator Oil Co.'s No. 1 G. J. Luther, in SW cor. G. J. Luther 32-ac. tract ....Plug; T. D. 3,022 ft.; will plug back; showed salt water.
Imperator Oil Co.'s No. 2 G. W. Carter, 175 ft. from S and 35 ft. from W of G. W. Carter 171-ac. tract, William Daniel Sur. ....Shut down.
Jenkins et al's No. 1 V. T. Davis, SE cor. of 139.8-ac. tract, Nacogdoches County School Land ....Pumped 25 bbls. in 3 days; total depth 3,031 ft.
Kraft & Kelsey's No. 1 Enas in Vacancy strip on E side of Sam Allen and Wylie Enas farms in J. Prado Sur. ..Tested 1 ft. mud and salt water; total depth 2,973 ft.; to abnd.
Priest et al's No. 1 Blewitt, 175 ft. NW and SW of SE cor. of NW 84-ac. tract, E. Porter Sur. ....Shut down 3,187 ft. (corrected).
Pure Oil Co.'s No. 1 I. W. Thompson, 1,870 ft. SW of SW line of Nacogdoches County School Land Sur. and 225 ft. from SE line of lease in Mund Gross Sur. ....Coring 3,138 ft.
Pure Oil Co.'s No. 2 O. L. Swain, 200 ft. N of S line and 250 ft. E of W line of lease in John Walling Sur. ....Drlg. 1,710 ft.
Pure Oil Co.'s No. 3 W. F. Swain, 250 ft. N of S line and 200 ft. E of W line in John Walling Sur. ....Drlg. 2,527 ft.
Pure Oil Co.'s No. 2 Mary P. Neills 100-ac. tract, 225 ft. E of W line and 658 ft. S of N line, James Rose Sur. ....Drlg. 1,485 ft.
Pure Oil Co.'s No. 1 H. C. Gilbert 62-ac. tract, 250 ft. W of E line and 250 ft. S of N line, Mund Gross Sur. ....Cement setting 307 ft.
Pure Oil Co.'s No. 1 Sam Allen, 835 ft. E of W line and midway between N and S line of lease, J. Prado Sur. ....Drlg. 2,380 ft. (rotary).
Pure Oil Co.'s No. 1 R. E. Cade, 225 ft. S of N line and 623 ft. E of W line of lease in A. McPhail Sur. ....Cement setting 2,668 ft (rotary).
Pure Oil Co.'s No. 1 A. J. Tunnell, 250 ft. S of N line and 200 ft. W of E line of lease in Mund Gross Sur. ....Drlg. 3,226 ft. (rotary).
Pure Oil Co.'s No. 1 Davis, 127 ft. from S and 200 ft. from W of 139-ac. tract, Nacogdoches County School Land ....Derrick standing.
Pure Oil Co.'s No. 1 Mertie Elliott 101-ac. tract, 217 ft. E of W line and 672 ft. S of N line of lease, A. H. Wiley Sur. ....Testing 2,933 ft.
The Texas Company's No. 4 R. A. Tunnell, 335 ft. E of most easternly W line and 217 ft. S of N line of lease, John Walling Sur. ....Location.
Van Oil Association's No. 1 Tankersley, 200 ft. from E and 1,000 ft. from S of farm, L. Landers Sur. ....Location.
Vitek Oil Co.'s No. 1 Smith, 150 ft. S and 15 ft. from W of L. A. Smith 40-ac. farm in John Walling Sur. ..Derrick.
The Texas Company's No. 2 R. A. Tunnell 160 acres, 250 ft. S of N line and 200 ft. W of E line, John Walling Sur. ....Cement setting 2,800 ft.
Maud Powell's No. 1 Killam, 1,360 ft. from NW, along SW line from most S cor. of 52-ac. tract and 425 ft. NE to SW line, Jessie Russell Sur. ....Shut down 3,643 ft.; top Pecan Gap 2,800 ft.; base Pecan Gap 2,924 ft.

WOOD COUNTY

Loche & Clark's No. 1 A. C. Pick, 165 ft. S of NE cor. G. C. Reeves 25-ac. tract, Daniel Fuller Sur. ....Shut down 997 ft.

MUCH CARE REQUIRED IN BOILER INSPECTION

(Continued from Page 215)

and a dome, they are examined like the boiler.

The external inspection of water tube boilers consists of the same examination as is given to fire tube boilers. The tubes exposed directly to the heart of the fire must be particularly well examined for evidence of overheating. The plugs or handholes placed in headers to permit the insertion of the tubes and the cleaning of them are inspected for cracks.

Steam Drums and Mud Drums

Steam drums and mud drums should be examined as carefully and for the same defects as the shells of externally fired tube boilers. The fire brick lining of the furnace and the interior of the brick settling in general, as well as baffles controlling the direction of flow of the gases of combustion, must be examined for cracks and any other defects.

The external inspection of the setting can usually be made readily, as everything is in plain sight.

The connections of water columns and gauge glasses require examination in order to see that they are clear throughout their whole length, as these pipes are liable to become choked unless the water column and gauge glass are blown down under steam pressure frequently. The brass plugs in connections should be removed and a rod as large as the base of the pipes should be forced through to remove deposits from the walls of the pipes.

The blowoff pipes should be examined to see that they are clear. Owing to the lack of circulation in this pipe it is liable to become so choked up with sediment that even under full boiler pressure no water will come through it.

REVISED SPECIFICATIONS FOR GASOLINE SUBMITTED

(Continued from Page 215)

with oxygen at 95-100 pounds per square inch pressure and the pressure released at the bomb charging valve, in order to flush out air contained in the bomb. The bomb shall then be charged with oxygen at 95-100 pounds per square inch pressure for a third time, the charging valve closed and the bomb disconnected from the oxygen charging line.

d. The bomb and contents shall then be immersed in a steam bath and heated to 98-100° C. 208-212° F.) for two hours. At the completion of the two hours at 98-100° C. (208-212° F.), the bomb is removed and rapidly cooled with water while the charging valve is still closed. The pressure is released gradually and the bottle removed.

e. The contents of the bottle are then drained and its volume measured. To remove any insoluble gum in the bottle, two washings of 15-20 milliliters of a mixture of 1 part C.P. acetone and 1 part C.P. benzone shall be used. These washings are measured and added to the oxidized sample. The mixture is then filtered and sufficient measured out to give 100 milliliters of oxidized sample (plus the addition of gum solvent).

f. One hundred milliliters of oxidized sample is then evaporated in accordance with Method 530.1, except that a glass dish shall be used. (A "Pyrex" glass dish, No. 51, 90 mm. diameter by 50 mm. deep is suitable for this evaporation.)

g. Details of the equipment used by the air corps for the above test will be supplied upon request.

Packing and Marking

1. Material shall be delivered in commercial containers of such size as specified in circular proposals. Containers having a zinc coating on the interior shall not, under any circumstances, be used.

2. All containers shall be plainly marked with the name of the manufacturer, kind of gasoline, specification number and other information as the purchasing and contracting officer may direct.

3. For domestic shipment, current commercial practices which will insure delivery at destination in perfect condition will be followed; for export shipment, in accordance with Specification No. 2-22.

4. Shipments shall be marked in accordance with Specification No. 100-2.

Notes

1. This fuel is intended for use in hot running and high compression or supercharged engines.

2. The method numbers in this set of specifications refer to the method numbers as given in the Bureau of Mines Technical Paper No. 323-B. The latest method should be used. Method 100.13 is a revision of 100.12. (Copies of this paper may be obtained from the superintendent of public documents, Washington, D. C.)

3. The high cylinder temperature specified is necessitated by the relative deterioration in antiknock value of fuels owing their antiknock property to cracking or high aromatic content. The test procedure specified approximately duplicates the relative deterioration of unsaturated and aromatic compounds observed in tests of hot running multicylinder aircraft engines. The addition of tetraethyl lead to a gasoline containing any considerable quantity of aromatic or unsaturated compounds does not, in general, diminish the relative loss of antiknock value. The method of test for antiknock value is somewhat arbitrary but is tentative and will be modified to allow alternate methods as such become available, and have been the subject of comparative test.

4. The accelerated oxygen aging test specified is tentative pending the completion of an investigation by the Bureau of Standards of accelerated aging tests which duplicate storage conditions. This test has been found to bear some relation to the development of gum in storage. Furthermore, it has been found that the type of gasoline with which the air corps has heretofore operated will stand the test with ease. No gasoline has been found which will pass the test and develop excess gum in storage. The details of the test, as used by the air corps, were furnished by the Standard Oil Co. of New Jersey.

5. The modification of the federal specification for fighting grade volatility as regards eliminating the 5 per cent recovered point and substituting a maximum temperature for the 10 per cent evaporated point and a maximum Reid vapor pressure at 37.8° C. (100° F.) is done in order to safeguard against vapor lock and takes cognizance of the Bureau of Standards' investigations of the vapor pressure of 10 per cent evaporated point limits. The air corps has in service a considerable amount of equipment that was designed to operate on gasoline with 4-6 pounds per square inch Reid vapor pressure and, pending improvement of fuel systems in this equipment, safe operation can only be secured with a limit of 6.5 pounds on the vapor pressure.

NATURAL GAS FACTOR IN THE OIL MARKET

(Continued from Page 52)

at around $18 per ton and on this basis the natural gas is cheaper for heating in addition to the other advantages. It is stated that the Pacific company since late spring has made over 8,500 gas burner installations in homes formerly using coal, the number far exceeding expectations. Very few oil burners are being replaced with gas but it has reduced the number of new installations, an experience common to other cities where natural gas has been made available at costs comparable to those incident to the installation and operation of oil burners.

Industrial Demand

It is in the industrial field where the greatest competition between natural gas and oil is found. Many of the largest industrial concerns have already shifted from fuel oil to gas on long-time contract basis. In some cases both oil and gas are being used but usually the oil will be utilized only in emergencies.

Some of the largest industrial users are said to be obtaining their requirements under 15 cents per 1,000 feet. Figured on a basis of 1 bbl. of fuel oil per 5,500 to 6,000 feet of gas, this means a delivered price for fuel oil of from 65 to 80 cents per barrel. Prices on fuel oil for delivery in this territory have recently receded to those levels with some sales under the low of the price spread.

Refinery Situation

There is no disposition on the part of oil companies to criticize those responsible for making the natural gas available, the situation is being viewed as the inevitable development arising from the discovery of what is believed to be the largest natural gas supply on the Pacific Coast, within 200 miles of a major marketing outlet.

At the same time, executives have realized for several months that it would complicate a refining and marketing situation already sufficiently involved to satisfy the average operator. In the past, the average California refiner has been more dependent on the revenue derived from the heavy ends of his crude oil in profitably operating his refinery than have the refiners in other parts of the country.

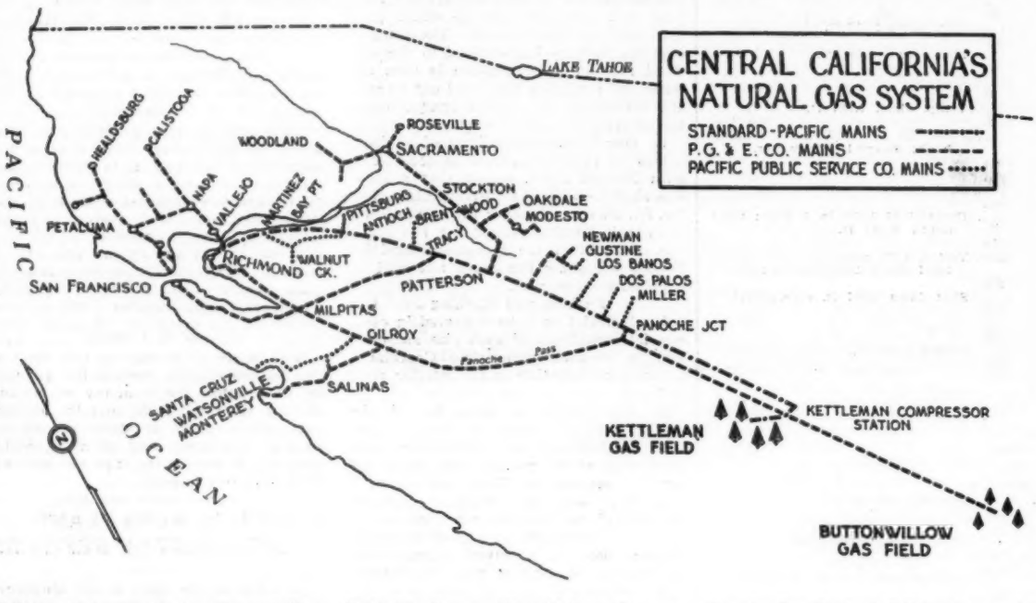
Except for Kettleman Hills which is still a minor factor in current refinery operations and two or three small fields, the crude oil has a relatively low gravity and without cracking facilities the fuel oil and gas oil yields represent from 50 to 75 per cent of the crude oil charge. Under healthy market conditions the refiner depended on the revenue from the fuel oil and gas oil to carry most of the refining cost including the cost of the crude oil. A comparison between the prevailing fuel oil prices at Coastal points and the prevailing posted schedules for crude oil shows that this situation does not obtain at this time.

In fact, the fuel oil market on the Pacific Coast has not been on a stable basis for the past two or three years due to an overproduction situation which has

been general for all the major refinery products. All the expansion of natural gas distribution has done, is to accentuate this situation and bring further price declines.

Most observers agree that the only possible solution to the problem is to reduce the California refinery output of fuel oil. The alternative is to ship more of its output to the East Coast and foreign points. In regard to the East Coast, that market has not been holding its own due to the large output available from local refineries and those located in Venezuela. Some of the other outlets for fuel oil are increasing but not enough to offset the declines so far as California is concerned.

As to a reduction in fuel oil output, an expansion in cracking facilities is obviously the only permanent method by which this can be accomplished. California refiners as a unit for several months, have been running less crude oil to their stills than they were a year ago.



Nothing more can be done in curtailing crude runs unless there is some compensating change in refinery operation which will give them additional gasoline supplies in line with the steady increase in domestic and export demand. This can be accomplished only by cracking.

Although the cracking capacity of West Coast refineries has increased during the past two years as shown by the government reports on the production of cracked gasoline, they still rank last among the several refining groups in percentage yields. This is explained as due to the fact that the refiners as a group lacked the incentives for maximum cracking yields that are general in other sections of the country.

Difficulties in Cracking

The fact that fuel oil prices were generally favorable in relation to gasoline and crude oil prices, as previously explained, naturally tended to keep many refiners from installing cracking units. Mechanical difficulties in the operation of cracking units and chemical problems in treating the cracked products also detracted from the attractiveness of cracking as a profitable phase of plant operation. This was due to the character of the charging stock.

As an additional factor, one operator points out that the bulk of straightrun gasolines from California crude oils are exceptionally high in antiknock value. In general, this rating is as high or higher than the cracked gasolines. Thus the situation differs from that existing in many Mid-Continent and Eastern refineries operating with paraffin or mixed base crudes where cracking is emphasized in order to secure high antiknock ratings in finished gasolines both for the regular and premium grades.

So far as the operating difficulties are concerned, most of the problems have been solved. Four of the licensed cracking processes have been in operation at one or more of the California refineries from one to five years and a fifth type is about to be installed. In some cases, operators have found it necessary to make important changes in the mechanical features and the treating problems have required special solutions.

Some operators have simplified their cracking problems by care in the selection of crude oils from which the charging stocks are obtained. It has been found that important differences exist in the cracking qualities of several crudes. Some of the deeper sand crudes in the Los Angeles Basin give gas oil cuts which are much easier to crack than some of the older crudes with high percentages of objectionable sulphur compounds.

Thus the manufacturing departments have paved the way for expansion in cracking facilities to the point where the production of fuel oil available can be limited to the quantity which can be marketed profitably. That these facilities will be expanded is of course based on the assumption that the present relative relationship between the cost of crude oil for the skimming operation and the cost of charging stock for cracking will not be materially changed.

The competition of natural gas apparently establishes a maximum price for fuel oil which cannot be changed unless the industrial rates for natural gas are advanced. In the crude oil end, prices could be reduced to the point where present fuel oil prices would be attractive and the refiners would continue to sell the bulk of their output to outside buyers and not expand their cracking operations. The latter development does not appear probable.

Standard Gas Properties

The largest refinery operator on the Pacific Coast, the Standard Oil Co. of California, is interested in the natural gas development of this section and probably will be a party to any additional expansion. Several oil companies are also directly concerned due to the ownership of properties already producing in the Kettleman Hills or those located within the proven areas.

The California Standard is credited with controlling more than 50 per cent of the proven acreage in Kettleman Hills. As shown in the accompanying map, the pipe line transportation of the natural gas from the Kettleman Hills and Buttonwillow Fields is in the hands of subsidiaries of the Standard of California and the Pacific Gas & Electric Co. The latter company built the first line along the coast extending to the San Francisco Bay region.

This was followed by the construction of a 26-inch line from Kettleman Hills to the San Francisco Bay region by the Standard Pacific Gas Line, Inc., owned jointly by the Pacific Gas & Electric Co. and the Standard Oil Co. of California. The latter company is in the natural gas distributing business through the Pacific Public Service Co., which it now controls.

Through subsidiaries the Pacific Public Service Co. is furnishing natural gas to some of the smaller communities in Coastal counties and is also selling industrial gas in the San Francisco area, part of which is not being served by the Pacific Gas & Electric Co. This includes the large Richmond refinery of the Standard of California.

The bulk of the distribution, however, is controlled by the Pacific Gas & Electric Co. which is constantly extending its lines to outlying points. This includes Sacramento and Stockton. The company, according to a late report, now has over 6,000 miles of gas lines serving industrial and domestic consumers.

In addition to its pipe line distribution the Standard of California is active in the development of outlets in small communities which are not connected to an outside supply of natural gas. Through its Pacific Public Service Co. the company is installing butane-air distributing systems in 30 communities located in California, Oregon and Washington. As in other parts of the country butane gas is manufactured at the company's natural gasoline plants and shipped by tank cars to the point of consumption where it is mixed with air. The butane-air fuel is then distributed by pipe line to the consumers. These installations are taking the place of artificial gas units.

In addition the Standard of California is rapidly developing outlets for "Flamo," the trade name of a liquefied gas which is stored in cylinders and sold in rural sections and small towns where no gas fuel of any kind is available.

In this connection it is stated that the electric companies are endeavoring to meet this liquefied gas competition with electric appliances. Rates on electricity are low in this section and it is claimed that where the electric power is available it can compete with the liquefied gas for cooking and similar uses.

BUILDING CRACKING UNIT

LOS ANGELES, Calif., Nov. 8.—The Vernon Oil Refining Co. will start construction immediately of a 500-bbl. cracking unit at its Vernon, Calif., refinery. The plant which will have a capacity of 500 bbls. daily, will be the vapor phase type. It is expected that the plant will be in operation by early spring.

The Vernon company has operated a skimming plant at Vernon for several years. The plant has a rated crude oil capacity of 3,000 bbls. daily.

REPORT ON STUDY OF PIPE LINE CORROSION

(Continued from Page 223)

Bureau of Standards is making a further study of this apparatus to determine the best size for electrodes and whether one, two or more dry cells should be used.

Other Questions Involved

Other questions also are involved, such as contact resistance, polarization and electrode material. Until further work has been done on this apparatus, the method should be considered as a rough and ready means of determining approximate resistivities and of locating points of abrupt changes in soil properties.

The significance of the correlation shown in this study are quite apparent to those who are concerned with the construction and protection of pipe lines. The most recent trend in pipe line protection is toward the idea of selecting a coating to meet the particular requirements involved, and away from a standard or uniform covering throughout the length of a line, irrespective of the character of the soil. The data herein support this trend, and suggest a practical means of carrying it into practice. They also support recent contentions[4] that destructive corrosion of pipe lines is largely confined to local bad soil areas or "hot spots" of comparatively small extent.

On existing lines two means of locating these corrosive areas are available, one being the measurement of long line currents and the other the measurement of soil resistivity.

Where current flow measurements are impracticable, or where it is desirable to ascertain soil conditions along a projected pipe line, it will be necessary to resort to the resistivity tests. The intervals at which such tests should be made will depend upon the character of the soil and perhaps many other factors. To be sure that no extensive hot spots are missed, it may be necessary in some locations to make tests at intervals of 100 feet or less; while in other areas the vegetation and topography may be depended on to a large extent to indicate the character of the soil. The value of such tests and the use to which they can be put will depend upon the thoroughness and intelligence with which they are conducted. They are not going to solve the corrosion problem, but they are tools which can be used to retard and minimize this destructive influence.

Future Work

Two classes of laboratory work will be continued during the coming year: The correlation of soil properties with corrosion and the examination of bituminous materials. The purpose of the first of these undertakings is to develop methods for identifying corrosive soils and to extend the usefulness of soil survey maps and data. The purpose of the second undertaking is to identify the bituminous materials furnished for field tests and to develop accelerated methods of testing.

While distinct progress has been made in the solution of underground corrosion problems, there is urgent need for much additional information along two lines, both of which involve the co-operation of pipe line organizations.

The first of these is a further investigation of methods of determining the corrosiveness of soils. Several methods have been proposed, all of which appear to be satisfactory under some conditions.

Comparative tests of these methods should be made along pipe lines under widely differing conditions where leak records are available, in order to determine the limitations of the methods and improve their reliability. The entire time of at least one man could well be given to this project until it is completed.

Second Field Undertaking

The second field undertaking which needs attention is a further study of protective coatings on working lines. Doctor Scott in his 1929 report to the American Petroleum Institute showed that a very large portion of the 500 examinations of coatings which he made disclosed distor-

[4] "Corrosion and Pipe Line Coverings," Charles Fitzgerald, Bull., Amer. Pet. Inst., June 2, 1930, p. 126; "Soil Characteristics and Corrosion," I. A. Denison, The Oil and Gas Journal, June 5, 1930.

tion of the coating and rust spots beneath the coating. From one examination at a given location it is impossible to determine the rate at which the rusting of the pipe is progressing. So many variables are involved in Doctor Scott's data it is very difficult to reach more than very general conclusions regarding the performance of the various types of coatings. While the American Gas Association and the American Petroleum Institute tests will be helpful in securing information regarding coatings, additional examinations of commercially applied coatings on working oil and gas lines would also throw much light on coating performance. The work should require the entire time of at least one man throughout the season in which field work can be carried on. The field study of the behavior of protective coatings should further be supplemented by study in the laboratory of those properties of soils which affect the useful life of coatings. From the results of such a study, it should be possible to specify the particular type of coating to be used under different conditions. It does not seem possible, however, for Doctor Scott to undertake this work during 1931, since his time should be devoted to the examination of coatings buried during 1930. Whether someone else can be found to carry on the examination of coatings on working lines appears doubtful. It may be necessary, therefore, to postpone this work until another year.

UNITIZATION ORDERED BY MEXICAN PRESIDENT

By C. E. Kern

Washington Bureau, The Oil and Gas Journal

WASHINGON, D. C., Nov. 10.—Unit operation of oil wells in Mexico has been ordered by a decree of the president of Mexico. A translation of this decree just received by the Department of Commerce, follows:

"Article 1. The Ministry of Industry, Commerce and Labor will permit, in cases where two or more petroleum concession holders solicit permission to explore and exploit, according to a defined technical plan, the lands entirely or partially covered by their concessions, if the lands included in said plan form a continuous surface area," to permit the sum of the investments required to keep up the regular works to be distributed over the entire tract during the time of exploration, as the plan in question may determine; with the understanding that at the end of said time, the unified lands will have received individually the benefits of the investment legally corresponding to them.

"Article 2. For compliance with the regulatory obligations with respect to the maintenance of regular works during the exploitation of the unified land, the Ministry of Industry, Commerce and Labor may likewise permit the production to be as determined by the technical plan, provided that at the end of each year the unified properties shall have fulfilled their individual obligations as regards production.

"Article 3. For the effects of the annual investment required by Article 49 of the regulations of the petroleum law, it shall be understood that this must be equal to the amount corresponding to each field where said investment is not made annually within the area of the unified land, the concessions are individually and simultaneously cancelled."

C. J. RANDELL DEAD

C. J. Randell, oil scout for the Shell Petroleum Corp. in the Seminole district with headquarters at Shawnee, died of heart failure on Monday, November 10, at his home. Mr. Randell, after attending a football game Saturday, returned home complaining of not feeling well and his condition grew steadily worse. He has been ailing for the past year. Mr. Randell has been with the Shell Petroleum Corp. for six years and formerly scouted the Enid district, being transferred to Shawnee about three years ago. He is survived by the widow, mother and one brother.

DEVICE THAT CONQUERED OKLAHOMA CITY'S WILD WELL

Here is shown the christmas tree that brought the Morgan Royalty Co.'s No. 1 Stout, Section 2-11-3w, in the Oklahoma City Field under control after it had blown wild three days, drenching a large area with oil and threatening Oklahoma's capital with a disastrous fire. Valves had failed to hold the pressure exerted by the enormous flow of gas and oil.

Control of the well was regained by use of a special die nipple made for the emergency by the American Iron & Machine Co., of Oklahoma City. Hughes Tool Co. high-pressure valves were used. A similar device made by the same company conquered the "Wild Mary" Sudik and the Sigmon wells when they got out of control in the southern part of the field. The die nipple was lowered over a 16-inch joint of 6⅝-inch casing which formed the top part of the No. 1 Stout's flow string.

MORE COMPLETED WELLS BUT LESS NEW OIL PRODUCTION IN OCTOBER

Completed wells in October in the fields east of California numbered 1,572, an increase of 21 over the September figures, but the initial production of 900,570 was 148,553 bbls. less than the total for September. There were four more dry holes and eight fewer gas wells drilled.

In new work a net gain of 64 is shown in rigs, but a falling off of 105 in drilling operations, a net drop of 41 operations.

SUMMARY OF ALL FIELDS
Wells Completed

	Comp.	Prod.	Dry	Gas
Eastern	225	1,134	42	63
Central Ohio	110	1,054	39	37
Lima	16	124	1	8
Indiana	25	113	6	11
Michigan	23	1,108	10	5
Kentucky	78	3,244	29	11
Illinois	24	380	8	1
Missouri	1	....	1	0
Kansas	111	17,150	45	29
Oklahoma	295	408,412	83	45
North Central Texas	155	2,473	100	13
East Central Texas	47	107,031	16	0
East Texas	2	....	2	0
West Texas	45	27,104	15	0
Panhandle Texas	50	12,423	7	12
Gulf Coast	113	38,657	34	1
Southwest Texas	124	34,116	50	7
North Louisiana	53	2,814	19	23
Arkansas	7	910	4	2
Mississippi	6	....	3	3
Montana	23	285	7	5
Wyoming	19	4,415	3	3
Colorado	5	30	2	2
New Mexico	39	237,593	4	1
Total October	1,596	900,570	530	252
Total September	1,551	1,049,123	526	290
Difference	45	148,553	4	38

Rigs and Wells Drilling

	Rigs	Drlg.	Total
Eastern	54	235	289
Central Ohio	46	161	207
Lima	4	28	32
Indiana	4	43	47
Michigan	66	117	183
Kentucky	11	153	164
Missouri	0	4	4
Tennessee	1	16	17
Illinois	2	28	30
Kansas	40	176	216
Oklahoma	104	558	662
North Central Texas	62	288	350
East Central Texas	8	25	33
East Texas	8	18	26
West Texas	33	172	205
Panhandle Texas	38	97	135
Gulf Coast	20	175	195
Southwest Texas	95	188	283
North Louisiana	46	100	146
Arkansas	10	46	56
Mississippi	15	28	43
Alabama	2	3	5
Montana	25	75	100
Wyoming	23	113	136
Colorado	13	80	93
New Mexico	13	98	111
Utah	1	29	30
Total October	744	3,054	3,798
Total September	680	3,159	3,839
Difference	64	105	41

ARTHUR W. THOMPSON DEAD

PITTSBURGH, Pa., Nov 9.—Arthur W. Thompson, president of the United Gas Improvement Co., until forced by ill health to abandon active work died here today of heart disease. Mr. Thompson was born in Erie, Pa., 55 years ago. He graduated from Allegheny College, Meadville, Pa., as a civil engineer and rose to a high position in the Baltimore & Ohio Railroad organization. He left the railroad to become president of the Philadelphia Co., which has large gas, electric light and power, and traction interests in the Pittsburgh district.

BUREAU OF STANDARDS FAVORS GAS BY UNITS

By C. E. Kern

Washington Bureau, The Oil and Gas Journal

WASHINGTON, D. C., Nov. 10.—The Bureau of Standards believes that fuel gas should be sold by the heat units.

Following a study made on behalf of the gas industry and the consuming public, the Bureau of Standards recommends the sale of gas by the heat unit, either by billing gas users directly for the number of heat units delivered or by providing that the rate per 1,000 feet shall vary automatically in proportion to the heating value, George K. Burgess, director of the bureau announced today.

The trend of sales in the last few years, it is stated by observers, the bureau says, has shown conclusively that the future expansion of the gas industry depends upon the ability to get industrial and space heating business and that this, unlike the domestic cooking load, can be secured only by a reasonably close cost competition with raw fuels. The freedom and ability to deliver the greatest number of B.t.u.'s (British thermal units) to the customer for $1 of cost is, therefore, the key to future development.

This freedom the industry will have, according to Doctor Burgess, if it will base its sales on heat units delivered, and with it will come a direct incentive to find the most economical methods of supplying available heat energy in every situation, Doctor Burgess says.

If the sale of gas by the heat unit is put into effect every desirable change of plan, source of materials, or operating procedure can be considered and adopted simply on its merits as affecting costs. If it is not put into effect every proposed change in production will drag in the infinitely more complicated question as to whether the company is already earning what it should, and the average company is likely to stand pat on its present operation long after it would normally be looking for improved methods if it were free to act.

ANDERSON BUYS PLANT OF MUSKEGON REFINERS

Purchase of the plant of the Muskegon Refiners, Inc., in the Muskegon oil field by Walter E. Anderson, former president of the Old Dutch Refining Co., is announced. The plant is to be enlarged at a cost of $30,000 to $50,000 to operate as a modern 2,000-bbl. refinery. It was indicated that operations will be started on Michigan crude with other adequate supplies in sight. Bubble towers will be erected and one of the present 250-bbl. shell stills will be converted into a pipe still. Present storage space for crude oil and refined products will be doubled.

The plant as it stands adjacent to the Pere Marquette Railroad tracks in the middle of the oil field was moved to Muskegon about 18 months ago from Lexington, Ky., where it had been operated by A. V. Smith as the Lafayette Refining & Storage Co. It was sold to the Muskegon Refiners, Inc., a new corporation, by Mr. Smith.

The plant was not operated and recently judgments were obtained against the company by creditors. All claims have been settled. Mr. Anderson bought the site on which the refinery stands several months ago from Charles Myler, vice president of the Muskegon Oil Corp., who owned it in fee.

Mr. Anderson went to Muskegon about 18 months ago as president and general manager of the Old Dutch Refining Co., operator of a 3,500-bbl. refining plant. He resigned from this position about six months ago. Mr. Anderson has been active in the marketing end of the petroleum industry for about 30 years. He was head of the Wenonah Oil Co., operator of a chain of service stations in Minnesota and Iowa. He also was active in the trade in Chicago, his home city.

Jack Helme, assistant superintendent at the Old Dutch Refining Co. plant, has been named superintendent of the Muskegon plant.

Late Fields

(Continued from Page 58)

the Viola lime at 4,015 feet, with 50 feet of oil in the hole.

GULF COAST

HOUSTON, Tex., Nov. 11.—Deep production in the 5,400-foot sand at Refugio was extended a half mile south when E. M. Jones' No. 2-A Mitchell was completed flowing 1,200 bbls. daily, taking in the sand at a total depth of 5,441 feet.

In the west extension district of Lockport, La., 2,000 feet west of production, Yount Lee Oil Co.'s No. 1 Miller came in flowing 700 bbls. daily. Total depth of the hole was 7,764 feet but the original hole was sidetracked and the well completed in a sand around 6,800 feet. This is the fourth producer in the area.

PRAIRIE AND SINCLAIR NOT REACHED AGREEMENT

NEW YORK, Nov. 10.—W. S. Fitzpatrick, chairman of the board of directors of the Prairie Oil & Gas Co., in a statement made here today said: "It is not true that an agreement has been reached for the merger of the Prairie Oil & Gas Co. and Prairie Pipe Line Co. with the Sinclair Consolidated Oil Corp. I fear we are further away from an agreement now than I thought we were some time ago. I do not care to say more at this time."

PETROLEUM INSTITUTE HAS FRANK DISCUSSION

(Continued from Page 47)

that no one aside from himself and the Institute's statistician would ever see such figures in the form received from the companies.

W. M. Irish, president of the Atlantic Refining Co. and vice president of the Institute in charge of the refining division, presided at the joint meeting. Joseph E. Pogue, acting chairman and secretary of the Federal Oil Conservation Board's committee on economics presented and explained that committee's report. John D. Gill, of the Atlantic Refining Co. and chairman of the statistical subcommittee of the Institute, went into detail on the features of the report of his committee.

Group Meeting Discussions

The economic situation of the petroleum industry is the keynote of this convention of the Institute. Naturally the technical sessions and group meetings devoted to specific production, refining, marketing and transportation problems touch only indirectly upon the economic phase, but the big problem dominating the whole convention is to devise ways and means of eliminating whatever wasteful methods and practices now existing which influence the general situation.

In this connection the matter of unit operation of oil pools is a dominant subject before the producing division. The rapid and extremely extensive expansion in filling station facilities is the problem worrying refiners and marketers.

Discussion of the code of marketing practices has a prominent place in meetings being held this week. After a year's operation and discussion of interpretations and efforts to iron out difficulties encountered, efforts are being directed to get more of the spirit of the code in actual operation. It is realized the code is an established part of marketing and the trend seems to be to make the interpretations more rigid. It is felt in some quarters a lenient interpretation has been given many features of the code and it seems probable a more strict interpretation will be given during the coming year.

Oil men have a greater opportunity at this convention to familiarize themselves with what is being done in each branch of the industry—what the problems of each branch are and what is being done to solve them—than at any previous convention of the Institute. This is the result of the separation of activities of the Institute into the three main divisions of production, refining and marketing and the holding by each of these divisions of business sessions. These business sessions are an innovation at American Petroleum Institute conventions, just as was the joint meeting last night of refiners and producers. The three divisions of the Institute will hold business sessions Thursday afternoon of this week and matters of especial interest to each division will be discussed at the meeting then. Reports of activities of committees of the divisions also are being made at these divisional business sessions. When it is considered that the producing division alone has 36 standing committees with 1,204 members distributed graphically throughout the United States, representing the executive, technical and practical departments of the producing and pipe line branches of the industry, the scope of the work being done might be visualized.

Mid-year Meetings Approved

The board of directors of the Institute yesterday approved recommendations of the three divisions that mid-year meetings be held by the divisions. Officers of the divisions were authorized to select the time and place of meeting. It is expected one division will hold its mid-year meeting in April, another division to meet in May and the third some time in June.

Production Division

In his report on activities of the division of production, William N. Davis of the Phillips Petroleum Co., Bartlesville, chairman of the division, said in part:

"The oil producers of the United States, through voluntary efforts, in co-operation with the authorities of their respective states have accomplished astonishing results in the movement to conserve the nation's petroleum resources by reduction of waste and to balance supply with demand. They have fallen short of the ideal in some respects and in some localities, but have attained a measure of success which would have been deemed impossible less than two years ago. The principles involved in the measures adopted have received the sanction of both legislative and judicial authority. Curtailment through proration has ceased to be an experiment; it is an essential factor in the operations of the industry and will continue to be so until the general adoption of unit operation has made it unnecessary.

"The purposes of curtailed and prorated production are prevention of waste and stabilization of the industry and the producers are not open to criticism if they are more interested in the last than in the first. A reasonable return on the capital invested, for the labor expended and the hazards involved may be justly demanded. It is essential not only to the petroleum industry, but to all business if the country is to be prosperous.

"The full measure of stabilization which might have been expected to result from the constructive action of the producers has not been realized; partly because of the large crude stocks on hand, but chiefly because the refiners of the country overestimated the coming demand and built up excessive stocks of gasoline. Since June they have been endeavoring to correct their position, but with only a partial measure of success and continued curtailment of refinery operations and of crude production are essential to a sound economic balance in 1931.

"In the period since the World War stocks of crude have grown to unnecessary and burdensome proportions, they have been somewhat reduced but are still excessive in view of the large potential current supply. However, the physical unbalance of the industry resulting from years of error cannot be cured in as many months. The corrective measures must be gradual or they will be destructive.

Producers Dilemma

"There is another reason why the producer has not reaped the reward which it would seem he has earned. The producer who curtails his production to his prorata part of the indicated current demand has a right to expect a stable market as the natural result of a balanced condition which he has helped to create. But if his production is so located that there is but one available purchaser and this purchaser cuts the price he must choose between shutting in his production and shutting off his income or contributing to general demoralization by selling below the prevailing competitive market price. Thus proration has failed in one of its primary purposes, stabilization, and will continue to do so unless there shall be a competitive market available for all oil produced when the aggregate current production has been curtailed to the indicated current demand."

Interest in the general session this afternoon which officially opened the convention meeting centered around the address of Col. William J. Donovan, former assistant attorney general of the United States who discussed "the anti-trust laws." His address is published in this issue of The Oil and Gas Journal.

While the meeting this afternoon might be technically called the only general session of the convention, the meeting on unit operation to be held Wednesday evening in the grand ballroom of the hotel really is another general session and is expected to attract a large attendance. C. B. Ames, vice president of The Texas Company, will speak at that session on "What's the Matter With the Petroleum Industry." Judge Ames' address is also published in this issue of The Oil and Gas Journal. At this meeting George Otis Smith of the United States Geological Survey and T. E. Swigart of the Shell Oil Co., will discuss phases of unit operation.

LOW PRICES QUOTED ON GULF COAST GASOLINE

HOUSTON, Tex., Nov. 11.—Two major sources of gasoline on the Gulf Coast were quoting for spot sale at the opening of the week on a basis of a cent and a quarter above North Texas prices. This would place motor fuel at 5¾ to 5⅞ cents at refineries here, the lowest prices which have been quoted here for immediate shipment. Contract material based on North Texas prices has been moving slowly but until now sellers have been attempting to hold spot business around 7 cents. When the market weakened to the latter figure some weeks ago several refiners withdrew from the market and the offers the past week were the first indication of an open break, although other refiners apparently still are holding firm and moving only such material as contracts demand. This weakness is in the face of a slightly better tone indicated in North Texas markets the latter part of the past week.

The reduction in the bunker oil market at New Orleans and Baton Rouge last week from $1 to 90 cents had not been followed at Texas ports up to Tuesday. At the latter points the posting remained $1.

The cut at Louisiana terminals was made because of reports that certain sellers at Texas ports had been quoting under the posted price of $1 and that some bunker oil was sold as low as 86 cents. It is indicated that the Texas port posting will be cut later but no definite information has been given out.

The bulk fuel market in general is unchanged. Strange as it may seem, Bunker C oil in cargoes, although weak, is stronger at Gulf ports than on the Atlantic seaboard. However, the market is weak with plenty of material available and little demand outside regular outlets.

A slight improvement in quoted prices was indicated with the removal of some slightly off specification fuel which had been priced at 62½ cents. This leaves the general market bottom at 65 cents.

Gas oil continues steady. Although buyers expect to fill their needs at 3½ cents for 30-32 zero test material, sellers evidently are of a different opinion and are holding firmly at 3¾ cents. No important sales indicative of a market are being made.

Pale and red oil are unsettled. The double crude price structure on the Gulf Coast in which Gulf Pipe Line Co. is paying from 6 to 22 cents under posted prices of other major purchasers is conducive of uncertainty, which is reflected in the lubricating oil situation, and to get any business of the latter some of the refiners are yielding to wide concessions under quoted markets.

H. D. WHITON DIES

HOUSTON, Tex., Nov. 10.—Henry D. Whiton, president of the Union Sulphur Co., Sulphur, La., producer of sulphur and oil on the Gulf Coast, died at his home in New York, October 31. He was 60 years old and had been president of his company since May, 1914. W. R. Keever, vice president of the company at Sulphur, represented the coastal offices at the funeral.

H. R. MACMILLAN TO SPEAK

The program for the United States Chamber of Commerce western divisional meeting to be held at Portland, Ore., December 8 and 9, includes a discussion of the problems confronting the oil industry and attempted methods of solution by Herbert R. MacMillan, president of the California Oil and Gas Association.

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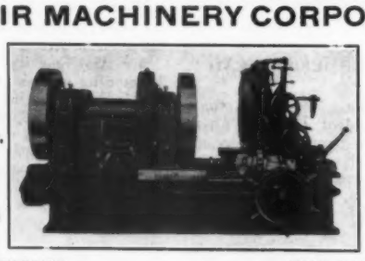

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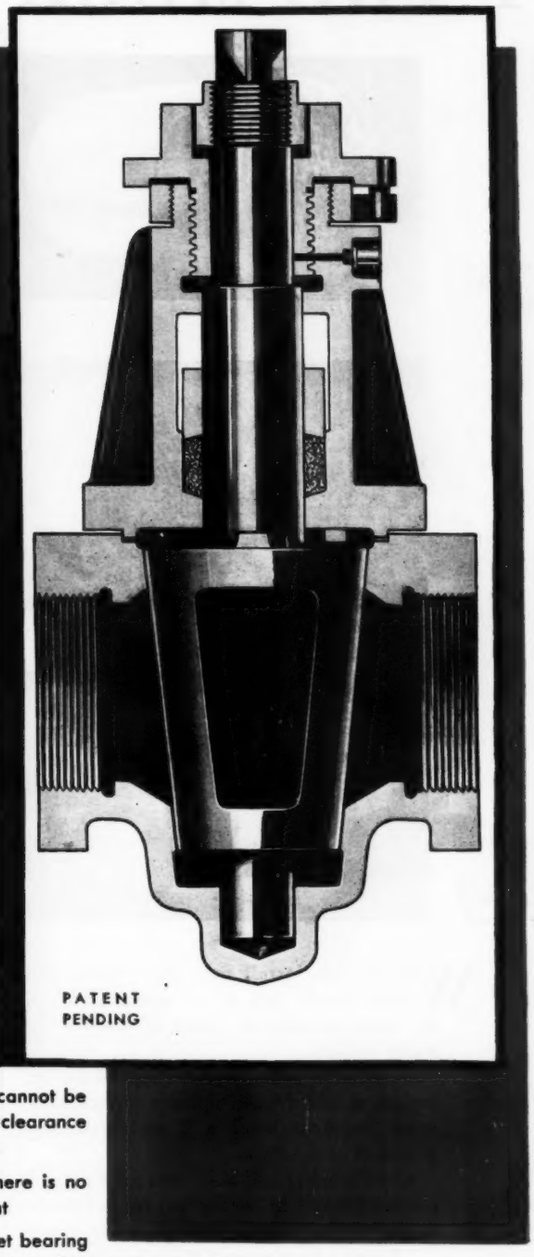

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The Screw-Lift Valve requires only a wrench on the elevating nut to readily unseat the plug . . . simple, direct mechanical action. A positive stop prevents the plug from being raised too far. This is one valve, the plug of which cannot be jammed in its raised position. When raised, there is sufficient clearance between the plug and seat to permit free rotation of the plug.

With no possibility of rotating the plug until it is raised, there is no opportunity for wear from friction on either the plug or seat

Plug alignment is positively assured by the adequate bonnet bearing and a pilot bearing below the plug. Consequently fluid velocity or line pressure cannot interfere with accurate plug seating.

These are features which assure positive and instantaneous control of any fluid line regardless of pressure and at any operating temperature. The Screw-Lift Valve is the plug valve best suited to pipe line, gasoline plant, and refinery operation.

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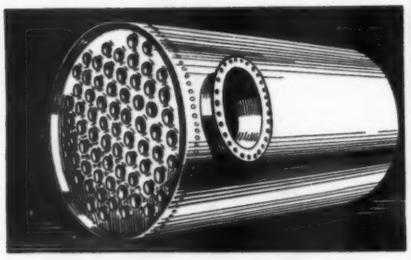

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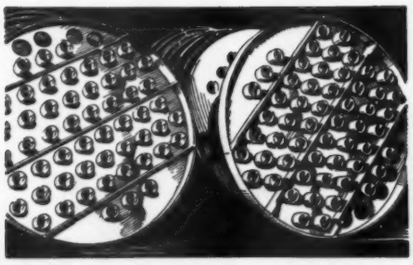

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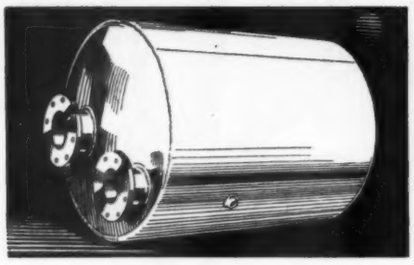

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BUREAU OF MINES STATISTICS FOR SEPTEMBER, 1930

SUPPLY AND DEMAND OF ALL OILS

(Including wax, coke and asphalt in thousands of barrels of 42 U. S. gallons)

NEW SUPPLY:	Sept., 1930	Aug., 1930	Sept., 1929	Jan.-Sept., 1930	Jan.-Sept., 1929
Domestic production:					
Crude petroleum	70,977	74,853	87,453	688,410	759,218
Daily average	2,366	2,415	2,915	2,522	2,781
Natural gasoline	4,079	4,212	4,574	38,974	38,398
Benzol	202	216	253	2,115	2,307
Total production	75,258	79,281	92,280	729,499	799,923
Daily average	2,509	2,557	3,076	2,672	2,930
Imports:					
Crude petroleum	5,808	5,059	6,953	47,874	62,727
Refined products	3,614	4,329	2,725	33,570	20,404
Total new supply, all oils	84,680	88,669	101,958	810,943	883,054
Daily average	2,823	2,860	3,399	2,970	3,235
Increase in stocks, all oils	*7,349	*7,030	5,498	*10,658	63,161
DEMAND:					
Total demand	92,029	95,699	96,460	821,601	819,893
Daily average	3,068	3,087	3,215	3,010	3,003
Exports:					
Crude petroleum	1,961	2,407	1,988	18,435	18,864
Refined products	8,753	12,567	8,570	103,652	99,849
Domestic demand	81,315	80,725	85,902	699,514	701,180
Daily average	2,711	2,604	2,863	2,562	2,568
Excess of daily average domestic production over domestic demand	†202	†47	213	110	362
STOCKS (end of month):					
Crude petroleum:					
East of California	376,975	381,640	392,798	376,975	392,798
California‡	144,229	144,372	150,759	144,229	150,759
Total crude	521,204	526,012	543,557	521,204	543,557
Natural gasoline at plants	534	744	661	534	661
Refined products	156,770	159,101	139,953	156,770	139,953
Grand total stocks, all oils	678,508	685,857	684,171	678,508	684,171
Days' supply	221	222	213	225	228
Bunker oil (included above in domestic demand)	4,333	4,702	4,424	38,648	39,528

*Decrease. †Deficiency. ‡Includes residual fuel oil.

REVISED TOTALS, JANUARY-JUNE, 1930

The final 1929 summary and the monthly report for August, 1930, which were issued at about the same time, introduced certain changes in method of reporting, as follows:

1. Actual crude production (pipe line runs plus fuel consumed on the leases plus or minus the change in producers' stocks) replaced the old figures of "crude production" which consisted solely of pipe line runs.
2. Exports of benzol were included in gasoline exports.
3. Producers' stocks of crude petroleum and stocks of motor blends held by natural gasoline plant operators were included in the table "Supply and Demand of All Oils" for the first time.

These changes have necessarily thrown certain of the data for the period January to June, 1930, out of line. The figures affected by these changes for those months are given below.

	Thousands of barrels					
Domestic production:	Jan.	Feb.	Mar.	Apr.	May	June
Crude petroleum	79,721	74,243	77,600	77,191	80,342	76,929
Total production	84,371	78,720	82,438	81,873	85,117	81,433
Total new supply, all oils	93,627	86,265	90,978	90,867	93,704	91,227
Increase in stocks, all oils	4,667	5,544	1,304	–1,992	1,723	–3,083
Total demand	88,960	80,721	89,674	92,859	91,981	94,310
Exports refined products	12,037	10,123	12,727	12,482	9,469	14,453
Domestic demand	75,115	68,867	75,003	78,477	80,309	77,349
Crude stocks east of California	386,176	387,356	386,157	385,925	385,019	384,222
Total crude stocks	535,167	539,326	538,281	535,727	533,491	530,543
Stocks refined products	158,955	159,469	161,727	162,253	166,001	165,858
Grand total stocks, all oils	693,333	698,377	700,681	698,689	700,412	697,329
Gasoline exports	5,527	4,888	6,288	5,771	5,012	7,322
Gasoline domestic demand	25,791	26,461	30,798	34,509	36,438	35,706
Production of crude petroleum by fields:						
Appalachian: Pa. Grade	2,191	2,136	2,283	2,408	2,448	2,139
Other	860	793	814	846	857	810
Lima, Northeast Indiana, Mich.	499	463	478	457	483	412
Illinois-Southwest Indiana	560	556	605	595	624	594
Mid-Continent:						
North Louisiana and Arkansas	2,800	2,775	3,016	2,976	2,790	2,907
West Tex.-Southeast New Mex.	10,743	9,926	10,621	9,843	10,089	9,713
Other	32,524	29,373	32,037	33,357	35,924	34,519
Gulf Coast: Grade A	2,461	2,755	3,013	2,985	2,771	2,683
Grade B	3,205	2,767	3,032	2,941	3,305	3,251
Rocky Mountain	1,595	1,813	2,001	2,014	2,007	1,880
California	21,983	20,886	19,700	18,769	19,044	18,021

SHIPMENTS FROM CALIFORNIA TO EASTERN PORTS IN UNITED STATES*

(Thousands of barrels of 42 U. S. gallons)

	Sept., 1930	Aug., 1930	Sept., 1929	Jan.-Sept., 1930	Jan.-Sept., 1929
Crude oil	.....	.....	.....	.....	1,299
Refined products	1,983	1,998	2,722	18,802	19,788
Gasoline	1,706	1,834	2,050	15,586	17,077
Kerosene	.....	.....	.....	180	72
Gas oil	272	157	658	2,674	2,387
Diesel oil	.....	.....	.....	208	98
Fuel oil	2	2	3	27	73
Lubricants	1	4	9	112	159
Asphalt	2	1	2	15	22

*Compiled by E. T. Knudsen of the San Francisco office of the Bureau of Mines.

NUMBER OF WELLS COMPLETED IN THE UNITED STATES*

	Sept., 1930	Aug., 1930	Sept., 1929	Jan.-Sept., 1930	Jan.-Sept., 1929
Oil	782	992	1,438	9,525	11,549
Gas	290	295	237	2,097	2,007
Dry	541	682	680	5,180	5,860
Total	1,613	1,969	2,355	16,802	19,416

*From The Oil and Gas Journal and California office of American Petroleum Institute.

RECORD OF WELLS FOR IMPORTANT FLUSH FIELDS, SEPTEMBER, 1930*

	Completions			Total initial prod. (bbls.)	Av. initial prod. (bbls.)	Drlg. Sept.
	Oil	Gas	Dry			
Texas	213	41	210	103,300	500	929
Darst Creek	11	0	0	10,900	1,000	18
West Texas	35	0	21	41,700	1,200	177
California	47	0	15	52,000	1,100	470
Long Beach	13	0	2	5,600	400	83
Playa Del Rey	15	0	1	10,200	700	98
Santa Fe Springs	1	0	1	500	500	4
Oklahoma	184	35	77	714,500	3,900	630
Oklahoma County	92	3	4	681,400	7,400	230
Pottawatomie and Seminole Counties	20	1	13	13,600	700	68
New Mexico	24	0	4	197,700	8,200	109
Lea County (Hobbs)	24	0	0	197,700	8,200	63
Other states	314	214	235	33,700	100	1,491
Total United States	782	290	541	1,101,200	1,400	3,629

*From The Oil and Gas Journal and California office of American Petroleum Institute.

(Continued on Next Page)

Actual PUMP INSPECTION *safeguards* ETHYL QUALITY

Ethyl inspector purchasing actual sample of Ethyl Gasoline *from the pump*. In Ethyl laboratories this sample must meet all Ethyl requirements.

MAYBE you've seen these inspectors, driving cars like this, stopping at Ethyl pumps, buying a gallon here and a gallon there. They are Ethyl representatives—making sure that all gasoline sold under the Ethyl emblem has the full extra quality of Ethyl Gasoline.

Each one of these cans is sealed and marked at the filling station and sent to Ethyl laboratories for testing.

The 76 oil refining companies that mix Ethyl fluid with their gasoline cooperate by authorizing these tests so all Ethyl Gasoline will meet the standard you have learned to expect.

Before any gasoline is mixed with Ethyl fluid at the refineries, a sample is sent to an Ethyl laboratory. A test shows how much Ethyl fluid is needed to bring it up to the standard of Ethyl Gasoline. At least this much Ethyl fluid is then added. After the mixing, a sample of the finished Ethyl Gasoline is sent for testing.

But even this is not enough. To make sure Ethyl Gasoline reaches you with quality unchanged, inspectors take samples from Ethyl pumps throughout the country.

So you are triply protected when you buy at the pump that bears the Ethyl emblem. Its standard of quality is never lowered. Ethyl Gasoline Corporation, Chrysler Building, New York City.

WITH ETHYL BRAND OF ANTI-KNOCK COMPOUND ETHYL GASOLINE CORPORATION NEW YORK, U.S.A.

Knocks out that knock

Wherever you drive—whatever the oil company's name or brand associated with it—*any* pump bearing the Ethyl emblem represents quality gasoline of high anti-knock rating.

GOOD GASOLINE plus ETHYL FLUID equals ETHYL GASOLINE

The active ingredient used in Ethyl fluid is lead

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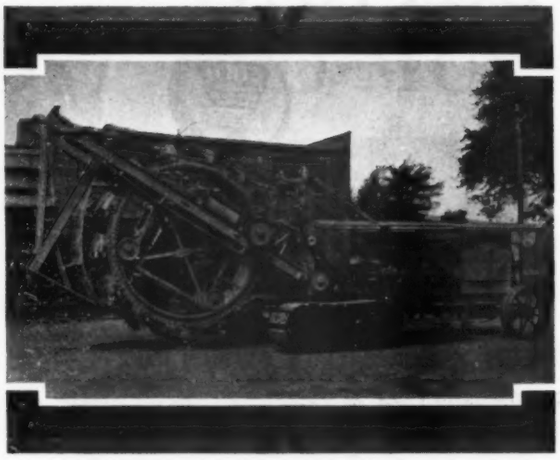
ETHYL GASOLINE



MIGHTY MODEL 48

Buckeye's Newest Pipe Liner

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Like its brother Buckeye Pipe Liners within their respective service ranges, big, powerful, speedy Model 48 sets the pace in cutting the largest pipe line trenches now required.

That ability has not been suddenly or miraculously acquired, and it is not flashy, temporary performance. Instead, it is a thirty-year-old habit that will be attested by thousands of owners for whom these Buckeyes have cut hundreds of thousands of miles of trench.

Three indisputable facts prove beyond question that Buckeyes *have been* and *are* the preferred standards of leading pipe line engineers and contractors. *First,* more Buckeyes are engaged throughout the world's oil and gas fields than all other makes combined. *Second,* probably 95 per cent of all major American cross-country pipe lines are laid in Buckeye-cut ditches. *Third,* many large pipe line contractors use them exclusively, while others employ them in large numbers.

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for over thirty years **Buckeye**

BUREAU OF MINES STATISTICS FOR SEPTEMBER, 1930

PRODUCTION OF CRUDE PETROLEUM BY STATES
(Thousands of barrels of 42 U. S. gallons)

	Sept., 1930 Total	Sept., 1930 Daily av.	Aug., 1930	Sept., 1929*	Jan.-Sept., 1930	Jan.-Sept., 1929*
Arkansas	1,573	52	1,638	1,946	14,965	19,340
California:						
Long Beach	3,013	101	3,203	5,096	27,726	48,728
Santa Fe Springs	3,059	102	3,376	8,427	35,836	58,127
Rest of State	11,912	397	12,191	12,601	110,397	115,731
Total California	17,984	600	18,770	26,124	173,959	222,586
Colorado	128	4	133	189	1,261	1,852
Illinois	405	14	520	532	4,496	4,757
Indiana:						
Southwestern	69	2	87	71	734	684
Northeastern	5	.....	4	5	41	48
Total Indiana	74	2	91	76	775	732
Kansas	3,484	116	3,448	3,963	31,768	32,221
Kentucky	619	20	608	722	5,683	5,531
Louisiana:						
Gulf Coast	755	25	787	635	5,999	5,524
Rest of State	1,169	39	1,215	1,142	10,826	9,591
Total Louisiana	1,924	64	2,002	1,777	16,825	15,115
Michigan	185	6	212	499	2,754	3,137
Montana	266	9	306	340	2,368	3,026
New Mexico	1,252	42	1,276	235	6,571	1,043
New York	290	10	244	282	2,919	2,493
Ohio:						
Central and eastern	420	14	405	422	3,981	3,930
Northwestern	108	4	103	120	1,019	1,140
Total Ohio	528	18	508	542	5,000	5,070
Oklahoma:						
Osage County	.....	.....	.....	1,178	.....	11,439
Oklahoma City	2,793	93	2,583	751	25,159	3,339
Seminole	5,174	172	5,046	11,819	62,222	107,244
Rest of State	.....	.....	.....	7,757	.....	72,760
Total Oklahoma	16,474	549	16,962	21,505	168,194	194,782
Pennsylvania	920	31	875	972	9,967	8,537
Tennessee	1	.....	3	1	13	16
Texas:						
Gulf Coast	4,942	165	5,252	4,148	47,040	35,504
West Texas	8,072	269	8,889	11,014	84,582	100,718
Rest of State	9,969	332	11,243	10,451	91,898	84,172
Total Texas	22,983	766	25,384	25,613	223,520	220,394
West Virginia	374	13	356	453	3,939	4,148
Wyoming:						
Salt Creek	861	29	875	973	7,964	8,508
Rest of State	652	21	642	708	5,479	5,919
Total Wyoming	1,513	50	1,517	1,681	13,443	14,427
Total United States	70,977	2,366	74,853	87,453	688,410	759,218

*Includes Alaska and Utah.

COMPARATIVE ANALYSES
(Thousands of barrels of 42 U. S. gallons)

	Sept., 1930 Total	Sept., 1930 Daily av.	Aug., 1930	Sept., 1929	Jan.-Sept., 1930	Jan.-Sept., 1929
CRUDE PETROLEUM:						
Runs to stills: Domestic	71,042	2,368	73,655	78,108	665,517	678,626
Foreign	4,908	164	5,634	5,991	46,023	58,968
Total	75,950	2,532	79,289	84,099	711,540	737,594
Imports	5,808	194	5,059	6,956	47,874	62,727
Exports	1,961	65	2,407	1,988	18,435	18,864
GASOLINE:						
Production*	36,944	1,231	37,844	37,605	336,166	323,713
Imports	1,538	51	1,827	901	13,264	6,108
Exports†	4,029	134	6,691	4,440	51,222	45,736
Stocks‡	38,254	.....	41,624	33,181	38,254	33,181
Domestic demand	37,823	1,261	37,433	34,680	303,215	283,996
KEROSENE:						
Production	3,846	128	3,975	4,600	38,167	41,206
Imports	35	1	2	.....	162	144
Exports	1,372	46	1,693	1,105	13,259	14,770
Stocks	7,771	.....	8,030	8,569	7,771	8,569
Domestic demand	2,768	92	2,573	3,320	26,394	27,012
GAS OIL AND DISTILLATE FUELS:						
Production	7,051	235	6,821	.....	60,168	.....
Stocks	19,371	.....	18,332	.....	19,371	.....
RESIDUAL FUEL STOCKS:						
Production	22,872	762	23,031	.....	224,438	.....
Stocks§	22,109	.....	21,397	.....	22,109	.....
GAS OIL AND FUEL OIL:						
Production	29,923	997	29,862	37,546	284,606	337,416
Imports	2,035	68	2,489	1,811	19,907	14,008
Exports	2,373	79	3,057	1,953	28,349	27,602
Stocks	41,480	.....	39,729	40,646	41,480	40,646
LUBRICANTS:						
Production	2,723	91	2,971	2,852	26,737	26,154
Imports	2	.....	3	3	20	32
Exports	685	23	826	691	7,781	8,282
Stocks	10,257	.....	10,161	7,589	10,257	7,589
Domestic demand	1,944	65	1,940	2,053	16,988	18,655
WAX (thousands of pounds):						
Production	43,960	1,465	39,760	44,513	437,640	473,818
Imports	913	30	1,677	2,896	19,963	30,110
Exports	30,175	1,006	23,697	31,990	209,912	227,160
Stocks	248,940	.....	264,990	187,319	248,940	187,319
Domestic demand	20,748	692	17,749	22,749	188,343	202,003
COKE (short tons):						
Production	170,200	5,673	172,100	161,200	1,433,200	1,322,400
Stocks	1,044,800	.....	994,200	711,000	1,044,800	711,000
ASPHALT (short tons):						
Production	306,400	1,021	345,600	364,700	2,514,400	2,678,100
Stocks	269,600	.....	315,800	230,500	269,600	230,500
ROAD OIL:						
Production	550	18	816	784	4,555	7,744
Stocks	307	.....	415		307	
MISCELLANEOUS:						
Production	835	28	867	682	5,797	682
Stocks	554	.....	488		554	

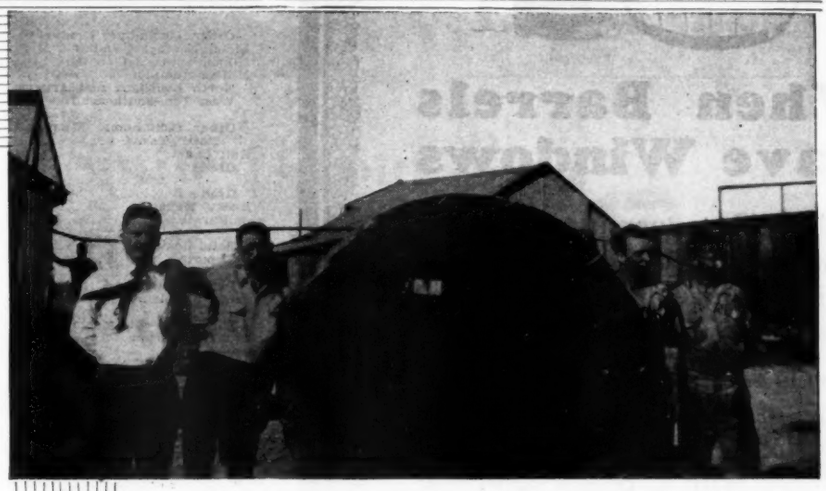
*Includes benzol production and natural gasoline used elsewhere than at refineries east of California. †Includes benzol. ‡Includes motor fuel blends held at natural gasoline plants. §East of California.

GASOLINE PRODUCTION BY THE VARIOUS METHODS, SEPTEMBER, 1930
(Thousands of barrels of 42 U. S. gallons)

	Straightrun Total	Straightrun %	Cracked Total	Cracked %	Natural gasoline Total	Natural gasoline %	Grand total
East Coast	2,487	47	2,630	50	128	3	5,245
Appalachian	692	57	447	37	70	6	1,209
Ind., Ill., Ky., etc.	2,468	46	2,588	49	262	5	5,318
Okla., Kans., Mo.	2,902	55	1,951	37	411	8	5,264
Texas	4,047	47	3,514	40	1,113	13	8,674
Louisiana and Arkansas	850	38	1,087	48	312	14	2,249
Rocky Mountain	429	40	514	47	139	13	1,082
California	4,345	58	1,547	21	1,591	21	7,483
Total	18,220	50	14,278	39	4,026	11	36,524
Texas Gulf Coast	2,556	41	2,806	45	849	14	6,211
Louisiana Gulf Coast	632	40	772	48	187	12	1,591

(Continued on Next Page)

A HUNDRED
Miles South of McCamey - - and More than a Mile Down



Mid-Kansas Oil & Gas Company's M. H. Goode No. 1, in Terrell County, Texas. The men, left to right: H. G. Alston, Union Wire Rope Corp.; Albert Flaherty, Southern and Flaherty, Drilling Contractors; Kelly Hawker, Driller; J. W. Wineman, Driller.

The above scene is at a well drilling at about 5300 feet, approximately 100 miles south of McCamey; Southern and Flaherty, contractors . . . . . The truck men that transported this heavy reel of 1" x 10,000' UNION Drilling Cable into the wilds of West Texas had quite a trip to make. Which was good reason for taking in a good drilling line - - one that could be depended upon to do the job . . . . UNION Wire Lines for the oil industry are always dependable because they are correctly designed by practical oil men and built by precision methods which insure absolute uniformity.

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THERE'S no guessing as to what or how much they contain. If it's liquid, the level-line will show up plain as day.

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MID-CONTINENT AGENCY

Originators of Oil-Froth Absorbers

BUREAU OF MINES STATISTICS FOR SEPTEMBER, 1930

PRODUCTION OF CRUDE PETROLEUM BY FIELDS
(Thousands of barrels of 42 U. S. gallons)

FIELD:	Sept., 1930 Total	Sept., 1930 Daily av.	Aug., 1930	Sept., 1929	Jan.-Sept., 1930	Jan.-Sept., 1929
Appalachian:						
Pennsylvania Grade	1,780	60	1,681	1,945	18,983	17,393
Other (including Kentucky)	844	28	810	907	7,519	7,262
Lima, Northeast Indiana, Mich.	298	10	319	624	3,814	4,325
Illinois-Southwest Indiana	474	16	607	603	5,230	5,441
Mid-Continent:						
North Louisiana and Arkansas	2,742	91	2,853	3,088	25,791	28,931
West Tex.-Southeast New Mex.	9,264	309	10,110	11,161	90,691	101,344
Other (Oklahoma, Kansas, North Texas, etc.)	29,927	997	31,653	35,919	291,860	311,175
Gulf Coast:						
Grade A	2,630	88	2,705	4,783	24,773	41,028
Grade B	3,067	102	3,334		28,266	
Rocky Mountain	1,967	65	2,011	2,299	17,524	*19,733
California	17,984	600	18,770	26,124	173,959	222,586
Total	70,977	2,366	74,853	87,453	688,410	759,218
CLASSIFICATION BY GRAVITY (approx.):						
Light crude	62,557	2,085	66,064	79,117	608,226	684,140
Heavy crude	8,420	281	8,789	8,336	80,184	75,078

*Includes Alaska and Utah.

INDICATED DOMESTIC DEMAND FOR CRUDE PETROLEUM, EAST OF CALIFORNIA
(Thousands of barrels of 42 U. S. gallons)

Domestic petroleum by fields of origin:	Sept., 1930 Total	Sept., 1930 Daily av.	Aug., 1930 Total	Aug., 1930 Daily av.	Jan.-Sept., 1930	Jan.-Sept., 1929
Appalachian:						
Pennsylvania Grade	2,274	76	2,025	*66	18,143	24,875
Other (including Kentucky)	802	27	833	27	7,485	
Lima, Northeast Indiana, Mich.	236	8	128	4	2,955	4,928
Illinois-Southeast Indiana	698	23	579	*19	5,694	6,497
Mid-Continent:						
North Louisiana and Arkansas	2,918	97	2,803	90	26,533	427,677
West Tex.-Southeast New Mex.	11,129	371	10,666	344	97,623	
Other (Oklahoma, Kansas, North Texas, etc.)	33,050	1,102	33,081	1,067	293,867	
Gulf Coast:						
Grade A	3,164	105	3,194	103	26,587	38,424
Grade B	2,221	74	3,168	102	27,430	
Rocky Mountain	1,696	56	1,968	*64	17,719	21,040
California	16	1	14	.....	201	.....
Total demand	58,204	1,940	58,462	1,886	524,237	523,441
Exports	1,507	50	1,675	54	12,068	13,171
Domestic demand	56,697	1,890	56,787	1,832	512,169	510,270
Foreign petroleum	5,282	176	5,568	180	48,670	62,870
Total domestic demand east of California	61,979	2,066	62,355	2,012	560,839	573,140

*Revised.

IMPORTS AND EXPORTS OF CRUDE PETROLEUM AND MAJOR REFINED PRODUCTS*
(Thousands of barrels of 42 U. S. gallons)

	Sept., 1930 Total	Sept., 1930 Daily av.	Aug., 1930	Sept., 1929	Jan.-Sept., 1930	Jan.-Sept., 1929
CRUDE PETROLEUM:						
Imports	5,808	194	5,059	6,953	47,874	62,727
From Mexico	995	33	1,271	1,604	7,491	10,200
From Venezuela	3,140	105	2,232	4,394	27,671	41,244
From Colombia	1,449	48	1,176	845	10,776	8,913
From other countries	224	8	280	110	1,936	2,370
Exports:						
Domestic crude oil	1,961	65	2,407	1,988	18,435	18,864
To Canada	1,722	57	1,935	1,782	14,715	15,940
To other countries	239	8	472	206	3,719	2,917
Shipments	.....	.....	.....	.....	1	7
Foreign crude oil	.....	.....	.....	.....	.....	.....
REFINED PRODUCTS:						
Gasoline:						
Imports	1,538	51	1,827	901	13,264	6,108
Exports†	4,029	134	6,691	4,440	51,222	45,736
To United Kingdom	955	32	2,035	872	15,319	12,729
To France	419	14	934	618	7,087	6,455
To Canada	468	15	578	484	3,363	3,946
To other countries	2,070	69	3,076	2,284	24,560	21,582
Shipments	117	4	68	182	894	1,024
Kerosene:						
Exports	1,372	46	1,693	1,105	13,259	14,770
To China	205	7	327	106	2,124	2,576
To United Kingdom	248	8	415	79	2,179	1,928
To other countries	896	30	945	916	8,747	10,101
Shipments	23	1	6	4	209	165
Gas oil and fuel oil:						
Imports	2,035	68	2,489	1,811	19,907	14,008
Exports	2,373	79	3,057	1,953	28,349	27,602
To Chile	417	14	299	396	3,374	4,322
To Panama	183	6	391	72	2,323	2,201
To other countries	1,724	57	1,878	1,376	19,686	18,706
Shipments	49	2	489	109	2,966	2,373
Lubricants:						
Exports	685	23	826	691	7,781	8,282
To United Kingdom	140	5	207	97	1,585	1,429
To France	70	2	159	59	1,167	1,205
To other countries	464	16	453	530	4,958	5,578
Shipments	11	...	7	5	71	70
Wax (thousands of pounds):						
Imports	913	30	1,677	2,896	19,963	30,110
Exports	30,175	1,006	23,697	31,990	209,912	227,160
To United Kingdom	8,614	287	6,590	9,453	55,059	54,849
To Italy	8,088	270	4,626	3,650	32,550	21,266
To other countries	13,468	449	12,470	18,884	122,281	151,007
Shipments	5	...	2	3	22	33

*From Bureau of Foreign and Domestic Commerce. †Gasoline exports include benzol —200 bbls. in September, 1930.

PRODUCTION AND DISTRIBUTION OF NATURAL GASOLINE
(Thousands of barrels of 42 U. S. gallons)

	Sept., 1930 Total	Sept., 1930 Dly. av.	Aug., 1930 Total	Aug., 1930 Dly. av.	Jan.-Sept., 1930 Total	Jan.-Sept., 1930 Dly. av.
Production	4,079	136	4,212	136	38,974	143
Decrease in all stocks	234	8	182	6	.....	....
Total	4,313	144	4,394	142	38,974	143
Blended at refineries	3,930	131	3,915	126	33,259	122
Run through pipe lines in California	96	3	97	3	1,440	5
Blended at plants*	18	1	18	1	203	1
Sold direct to jobbers	200	7	200	6	1,850	7
Increase in all stocks	....	....	....	....	282	1
Balance	69	2	164	6	1,940	7
Total	4,313	144	4,394	142	38,974	143

*East of California.

(Continued on Next Page)

The "Moly" Smile is Your Proof of Perfect BALANCE

WATCH a gang at work with Wood's Shovels. You'll see their smiling testimony . . . to the perfect BALANCE that makes hard shoveling jobs easier. Workmen just naturally like the easy hang and heft. Bosses will tell you that Wood's BALANCED SHOVELS make a difference in tons of material moved each day with the least amount of sweating and straining.

There's a perfectly BALANCED Wood's Shovel of just the *right* type and *right* price to suit *your* shoveling needs. You'll smile, too, at the renewed vigor of your workers and the amount of work they'll do.

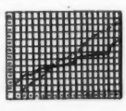
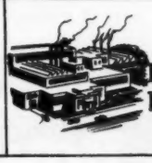
THE WOOD SHOVEL AND TOOL COMPANY
Piqua, Ohio

Wood's Shovels

"Moly"—"Big Fist"—"Piqua"

8 Checking Points *for the* Shovel Buyer

Don't take our word for it. Conduct your own comparison tests. Convince yourself that Wood's Shovels excel at all eight vital points.

1		Hardness and Toughness
2		Balance
3		Grip
4		Step
5		Uniformity
6		Service Record
7		Reliability of Dealer
8		Reputation of Manufacturer

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Oklahoma City, Oklahoma

a Stimulant to LOW PRESSURE WELLS

THE LAYNE MILLED GROOVE screen

The *Layne Milled Groove Screen* is manufactured to meet every screening condition, and it has gained world fame as a stimulant to low pressure wells. Large and important oil companies abroad and in this country will testify to this fact.

The *Layne Milled Groove Screen* increases production from 33-1/3% to 100% under normal conditions.

Should your problem be especially difficult, send us samples of the formation and the proper screen for best results will be prescribed.

The *Layne Milled Groove Screen* also prevents sand cutting and avoids clogging with mud and sand.

Install the "greater production" *Layne Milled Groove Screen* instead of wishing you had.

Write, wire or phone for quick service or further information.

The Layne & Bowler Co.

Houston Texas

Install Milled Groove Instead of Wishing You Had

The Layne New York Co. 30 Church St., New York

The Layne & Bowler Corp. Los Angeles, Calif.

Vickers, Limited London, England

BUREAU OF MINES STATISTICS FOR SEPTEMBER, 1930

STOCKS OF CRUDE PETROLEUM

(Thousands of barrels of 42 U. S. gallons)

EAST OF CALIFORNIA:	Sept. 30, 1930	Aug. 31, 1930	Sept. 30, 1929
At refineries by location:			
East Coast: Domestic	10,306	10,969	8,899
East Coast: Foreign*	4,204	3,706	3,793
Appalachian	2,638	2,857	2,803
Indiana, Illinois, Kentucky, Michigan, etc.	2,978	3,199	2,809
Oklahoma, Kansas and Missouri	5,274	5,282	5,669
Texas: Inland	1,982	2,144	1,745
Texas: Gulf Coast: Domestic	8,971	9,455	10,438
Texas: Gulf Coast: Foreign*	317	338	628
Arkansas and Inland Louisiana	984	1,112	1,347
Louisiana Gulf Coast: Domestic	5,736	5,314	4,384
Louisiana Gulf Coast: Foreign	768	719	1,663
Rocky Mountain	1,823	1,689	1,343
Total	45,981	46,785	45,521
At refineries by origin:			
Pennsylvania Grade	2,403	2,679	(†)
Other Appalachian (including Kentucky)	935	877	(†)
Lima, Northeast Indiana, Michigan	162	148	(†)
Illinois-Southwest Indiana	96	127	(†)
North Louisiana and Arkansas	5,268	4,851	(†)
West Texas and southeast New Mexico	4,866	5,286	(†)
Oklahoma, Kansas, North Texas, etc.	17,485	18,833	(†)
Gulf Coast: Grade A	4,253	4,323	(†)
Gulf Coast: Grade B	3,402	3,209	(†)
Rocky Mountain	1,817	1,688	(†)
California	5	1	(†)
Foreign*	5,289	4,763	6,084
Total	45,981	46,785	45,521
Pipe line and tank farm:			
Pennsylvania Grade	5,605	5,823	4,524
Other Appalachian (including Kentucky)	892	908	765
Lima, Northeast Indiana, Michigan	1,503	1,457	529
Illinois-Southwest Indiana	10,091	10,286	10,302
North Louisiana and Arkansas	20,842	21,423	22,252
West Texas and southeast New Mexico	46,357	47,764	257,018
Oklahoma, Kansas, North Texas, etc.	195,967	197,629	
Gulf Coast: Grade A	7,096	7,561	
Gulf Coast: Grade B	11,977	11,332	20,715
Rocky Mountain	24,314	24,172	24,739
Total	324,644	328,355	340,844
Total refinery, pipe line and tank farm	370,625	375,140	386,365
Producers' stocks	6,350	6,500	6,433
Total crude east of California	376,975	381,640	392,798
CLASSIFICATION BY GRAVITY (approximately):			
East of California: Light	334,479	338,582	345,298
East of California: Heavy	36,146	36,558	41,067
California: Light	40,582	40,671	40,627
California: Heavy (including fuel)	103,647	103,701	110,132

*Includes importers' stocks. †Not available.

RUNS TO STILLS AND OUTPUT OF REFINERIES, SEPTEMBER, 1930

(Thousands of barrels of 42 U. S. gallons)

	Crude oil			Unfinished oils rerun	Natural gasoline	Total input
	Domestic	Foreign	Total			
East Coast	9,933	4,684	14,617	963	128	15,708
Appalachian	2,632	.....	2,632	222	70	2,924
Indiana, Illinois, Kentucky, etc.	8,940	.....	8,940	189	262	9,391
Oklahoma, Kansas, Missouri	8,986	.....	8,986	339	411	9,736
Texas	18,075	79	18,154	1,050	1,113	20,317
Louisiana and Arkansas	4,564	145	4,709	552	312	5,573
Rocky Mountain	1,689	.....	1,689	366	139	2,194
California	16,223	.....	16,223	319	*1,591	18,133
Total United States	71,042	4,908	75,950	4,000	4,026	83,976
Texas Gulf Coast	13,200	79	13,279	861	849	14,989
Louisiana Gulf Coast	3,092	145	3,237	71	187	3,495

	Gas oil and fuel oils						
	Gasoline	Kerosene	Gas oil and distillate fuels	Residual fuel oils	Total	Lubricants	Wax†
East Coast	5,245	545	1,853	5,122	6,975	830	19,880
Appalachian	1,209	316	218	325	543	443	7,280
Indiana, Illinois, Kentucky, etc.	5,318	380	703	1,265	1,968	291	2,800
Oklahoma, Kansas, Missouri	5,364	609	452	2,082	2,534	250	2,800
Texas	8,674	1,084	1,602	5,218	6,820	628	3,360
Louisiana and Arkansas	2,249	489	418	1,267	1,685	95	5,600
Rocky Mountain	1,082	84	57	351	408	37	2,240
California	7,482	339	1,748	7,242	8,990	149	.....
Total United States	36,524	3,846	7,051	22,872	29,923	2,723	43,960
Texas Gulf Coast	6,211	925	1,289	3,344	4,633	598	3,360
Louisiana Gulf Coast	1,591	421	195	806	1,001	86	5,600

			Other finished products				
	Coke (tons)	Asphalt (tons)	Road oil	Miscellaneous	Total	Unfinished products	Shortage
East Coast	12,400	152,900	54	35	89	380	669
Appalachian	2,500	9,100	...	28	28	157	139
Indiana, Illinois, Kentucky, etc.	56,500	41,500	168	345	513	267	128
Oklahoma, Kansas, Missouri	31,400	2,900	51	115	166	342	485
Texas	49,200	18,900	19	25	44	1,598	1,102
Louisiana and Arkansas	8,000	36,900	15	127	142	442	207
Rocky Mountain	10,000	200	78	28	106	334	83
California	200	44,000	165	132	297	115	517
Total United States	170,200	306,400	550	835	1,385	3,535	3,330
Texas Gulf Coast	40,000	18,900	19	2	21	1,483	798
Louisiana Gulf Coast	7,800	24,900	...	122	122	6	71

*Includes 96,000 bbls. run through pipe lines. †In thousands of pounds.

PRODUCTION OF MOTOR FUEL

(Thousands of barrels of 42 U. S. gallons)

Gasoline produced at refineries:	Sept., 1930 Total	Sept., 1930 Dly. av.	Aug., 1930	Sept., 1929	Jan.-Sept., 1930	Jan.-Sept., 1929
Straightrun	18,220	607	18,932	20,251	174,358	183,417
Cracked	14,278	476	14,466	12,803	122,941	103,581
Natural gasoline:						
Blended at refineries	3,930	131	3,915	3,965	33,259	31,593
Run through pipe lines*	96	3	97	223	1,440	1,841
Total	36,524	1,217	37,410	37,242	331,998	320,432
Other natural gasoline:						
Blended at plants†	18	1	18	60	203	524
Sold direct to jobbers	200	7	200	50	1,850	450
Benzol produced‡	202	7	216	253	2,115	2,307
Total motor fuel	36,944	1,232	37,844	37,605	336,166	323,713

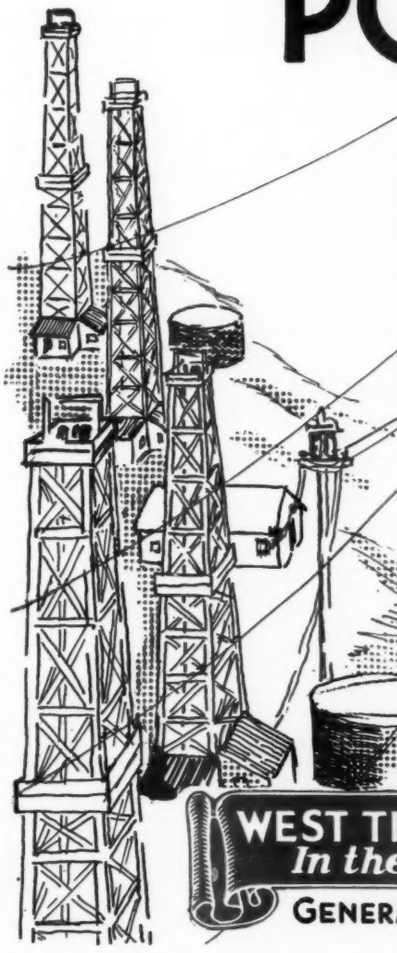
*To refineries in California. †East of California. ‡Estimated with production of by-product coke as a basis.

(Continued on Next Page)

SERVING WEST TEXAS

answering the big problem of the West Texas oil fields

ELECTRIC POWER



Eliminating the water problem and providing a source of power unaffected by corrosive fuels, electric power has answered the big problem of the West Texas fields. It permits the most flexible operation — insures maximum dependability and is entirely independent of road and weather conditions.

The West Texas Utilities Company is now serving more than 1,500 oil wells in West Texas and our power engineers can show you by comparative figures that unless your operations in the field are 100 per cent electrified you are wasting money.

WEST TEXAS UTILITIES COMPANY
In the Land of Opportunity
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PROOF— IS IN THE USE

COMBINEX
BALL AND SEAT

STEELEX seat—to resist sand. BRONZEX ball—to prevent lode-stone trouble.

PACKED IN GREEN BOX

REPELEX
BALL AND SEAT

Use this chromium alloy ball and seat where you have trouble with corrosion.

PACKED IN BROWN BOX

BRONZEX
BALL AND SEAT

A hard composition bronze alloy for lode-stone and alkali conditions.

PACKED IN YELLOW BOX

STEELEX
BALL AND SEAT

Where sand is excessive use STEELEX. An Alloy Steel Ball and Seat, heat treated.

PACKED IN RED BOX

DEALERS—EVERYWHERE SELL THEM

THE CHARLES N. HOUGH MFG. CO.
FRANKLIN, PA.

BUREAU OF MINES STATISTICS FOR SEPTEMBER, 1930

STOCKS HELD BY REFINING COMPANIES, SEPTEMBER 30, 1930
(Thousands of barrels of 42 U. S. gallons)

	Gasoline	Kerosene	Gas oil and fuel oil: Gas oil and distillate fuels	Gas oil and fuel oil: Residual fuel oils	Total
East Coast	5,425	1,826	5,338	6,799	11,137
Appalachian	1,168	213	688	539	1,227
Ind., Ill., Ky., etc.	5,462	742	1,852	2,461	4,313
Okla., Kans., Mo.	3,086	598	2,154	3,111	5,265
Texas	5,738	1,461	2,970	7,428	10,398
Louisiana and Arkansas	1,104	851	609	1,614	2,223
Rocky Mountain	1,896	254	100	1,157	1,257
California	14,363	1,826	5,660	(*)	5,660
Total	38,242	7,771	19,371	22,109	41,480
Texas Gulf Coast	3,757	1,344	2,614	4,474	7,088
Louisiana Gulf Coast	858	831	419	1,049	1,468

	Lubricants	Wax (thousands of pounds): Crude scale	Wax (thousands of pounds): Refined	Wax (thousands of pounds): Total	Coke (tons)
East Coast	3,282	56,424	19,351	75,775	50,100
Appalachian	1,311	25,378	3,287	26,665	7,600
Ind., Ill., Ky., etc.	1,018	17,195	2,896	20,091	158,400
Okla., Kans., Mo.	747	4,485	2,839	7,324	94,000
Texas	2,347	558	9,002	9,560	449,800
Louisiana and Arkansas	153	82,751	1,386	85,137	36,000
Rocky Mountain	180	20,728	1,660	22,388	126,100
California	1,219	.....	.....	.....	122,800
Total	10,257	208,519	40,421	248,940	1,044,800
Texas Gulf Coast	2,254	533	9,002	9,535	413,100
Louisiana Gulf Coast	147	82,751	1,386	85,137	35,900

	Other finished products: Asphalt (tons)	Road oil	Miscellaneous	Total	Unfinished oils: Natural gasoline	Other	Total
East Coast	102,600	33	38	71	98	9,602	9,700
Appalachian	6,200	..	77	77	6	1,502	1,508
Ind., Ill., Ky., etc.	51,200	66	265	331	37	5,525	5,562
Okla., Kans., Mo.	4,800	35	19	54	16	3,278	3,294
Texas	9,600	11	16	27	140	15,378	15,518
Louisiana and Arkansas	40,600	2	7	9	18	3,419	3,437
Rocky Mountain	4,400	39	21	60	1	1,623	1,624
California	50,200	121	111	232	1,721	†8,083	9,804
Total	269,600	307	554	861	2,037	48,410	50,447
Texas Gulf Coast	9,500	11	5	16	122	13,491	13,613
Louisiana Gulf Coast	35,700	..	6	6	8	2,648	2,656

*Included with heavy crude. †Includes 2,546,000 bbls. tops.

TEMPERATURE TESTS IN OKLAHOMA WELLS

Heat sufficient to cook eggs is encountered in many of the oil wells in Oklahoma, according to figures obtained by John A. McCutchin, research observer for the American Petroleum Institute, who has been taking deep well temperatures in Oklahoma for the past two years. McCutchin has found temperatures as high as 192.6° F. at a depth of 5,219 feet in eastern Oklahoma, and suspects that even higher temperatures may be found in some of the deep wells.

McCutchin is collecting data on well temperatures in Oklahoma under the direction of Dr. Charles N. Gould, director of the Oklahoma Geological Survey, but is employed by the American Petroleum Institute for the purpose of determining the relation of earth temperatures to oil accumulation. The information so far collected indicates that in general the temperatures become lower toward western Oklahoma and increase toward the oil fields of the eastern part of the State. However, a recent well tested in the mining district of Ottawa County would indicate a lowering of temperatures to the east after reaching a maximum in eastern Osage and Washington Counties.

The highest temperature so far recorded was found at a depth of 5,219 feet in a well in northern Pittsburg County, where the thermometer registered 192.6° F. The rate of increase in this well was 1° for each 40.2 feet, but the well was much deeper than any tested in Osage County.

In the deepest temperature test made, in the Sinclair well in Harper County, the reading was 166.8° F. at 7,625 feet. Due to caving at the bottom of the hole the total depth of the well, 8,590 feet, could not be tested.

Some of the variations found by McCutchin in different parts of the State are shown by the average rate of increase in the following: Eastern Osage County, 1° in 35.5 feet; northern Pittsburgh County, 1° in 40.2 feet; Latimer County, 1° in 56.7 feet; LeFlore County, 1° in 51.2 feet; Oklahoma City, 1° in 107 feet; Harper County, 1° in 74.4 feet; Ottawa County, 1° in 120 feet; Healdton Field, 1° in 150 feet.

The Healdton Field in southern Oklahoma gave the lowest temperature increase with depth with 150 feet required to raise the reading 1°. In general the temperatures are found to be higher in the central part of oil fields than in the nonproducing areas nearby, McCutchin said. For that reason the very low temperature in the Healdton Field has been of great interest.

The purpose of collecting deep well temperature data in Oklahoma, according to Doctor Gould, is to attempt to determine whether there is any relation between temperatures and oil accumulation. Only wells which have been idle long enough to attain a normal temperature equilibrium are used in making the tests. Three thermometers are lowered into the well by means of a piano wire, the machine used for lowering and raising being equipped with a meter for recording the depth of the thermometers. The three thermometers are checked against each other for errors, and readings are taken at various depths from 100 feet to the bottom of the hole.

NORTHERN ALBERTA PROSPECT

W. Maskelyne Miller of Vancouver, B. C., has completed a season's geological work in northern Alberta in the interests of an Alberta syndicate. Drilling will not be undertaken till a careful study is made of the geologist's report, which may be supplemented by further geological work and structure testing.

The operations are based on the theory that the Athabaska tar sands, the largest oil exposure in the world, are associated with a huge structure whose strike is east to west. Dr. G. M. Dawson and Dr. D. B. Dowling of the Geological Survey of Canada inclined to the theory that the McMurray tar sands drew their petroliferous content from the underlying Devonian limestone. "From what depth," adds Mr. Miller, "the drill alone can tell. Any enterprise, therefore, that has not for its objective the underlying palaeozoic strata is doomed to failure. The middle Devonian that evidences vast petroliferous tendencies further north on the Mackenzie Basin cannot be reached here under 4,500 feet. The Wainwright and Ribstone Fields also have great potentialities at the same horizon. It is folly to squander money on 2,000-foot holes for 4,500-foot oil. The structure conditions in the northern part of Alberta are huge and ideal, and infinitely preferable to the overshot, folded and crumpled strata of the foothills."

So far no test in northern Alberta has been carried to the middle Devonian.

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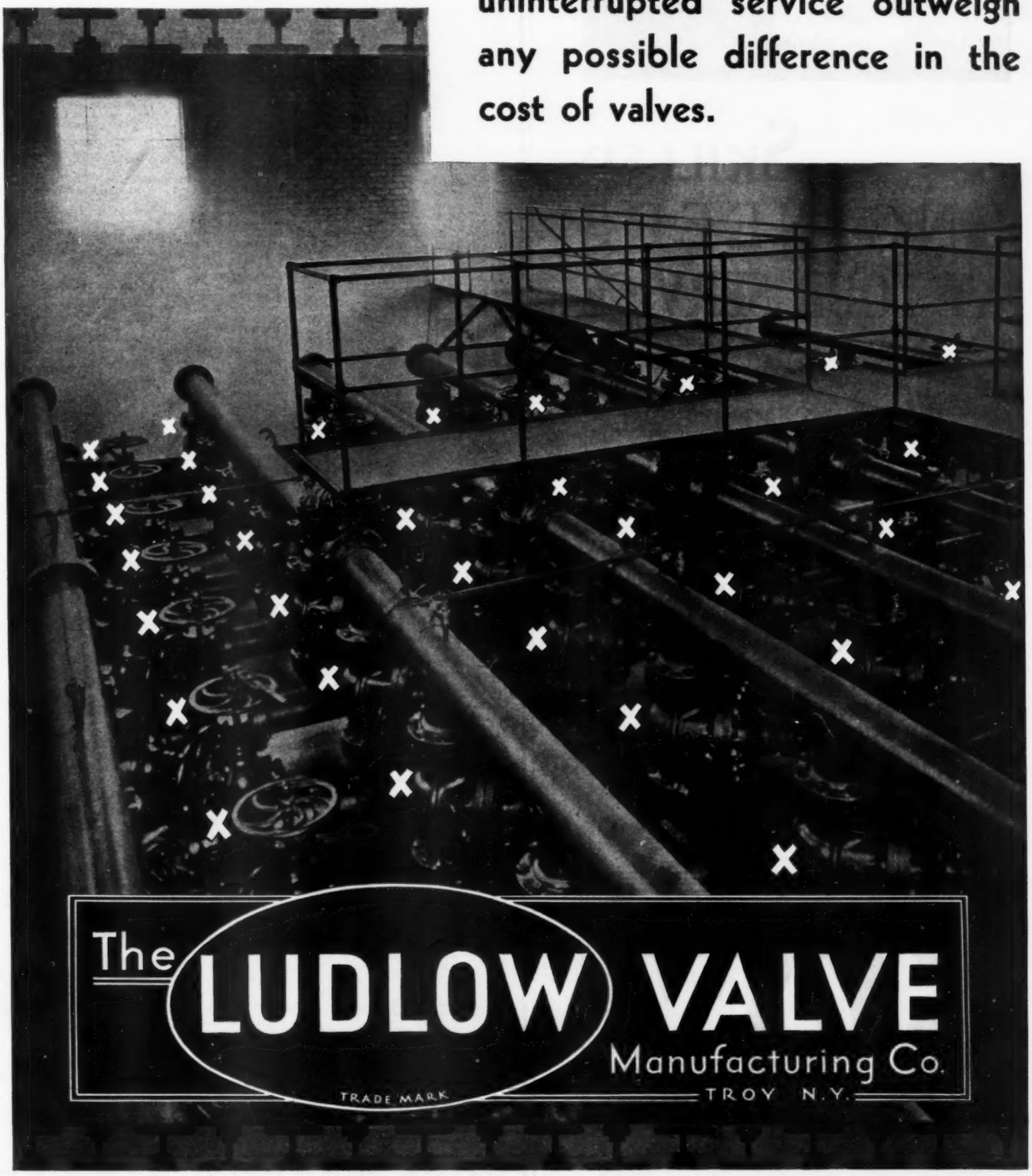
X marks Ludlow Valves serving Prairie Oil at Carrollton, Mo. Thousands throughout the oil and natural gas industries are proving that low valve cost per year and uninterrupted service outweigh any possible difference in the cost of valves.



The LUDLOW VALVE Manufacturing Co.
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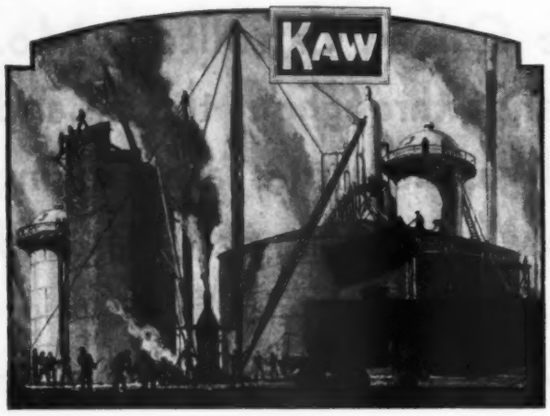

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KAW engineers, skilled through years of steel construction experience, are ready to serve you without charge. This service plus steel plate construction of the finest quality is why more and more oil field men depend upon KAW each and every year.

Modern Shop fabricating facilities combined with field erecting crews enable KAW to construct plate work of any type or description that may be built by riveting or welding.

PRODUCTS: Steel Storage Tanks—Refinery Equipment, specializing in Bubble, Evaporation and Vacuum Towers—Smoke Stacks and Breechings—Plate Steel, fabricated and erected—etc.

KAW STEEL CONSTRUCTION CO.
FIRST AND WALKER
KANSAS CITY KANSAS

KAW

WILDCAT OPERATIONS IN KANSAS

(Continued from Page 61)

GRAHAM COUNTY

Gulf Coast Oil Co.'s No. 1 Johnson, C S half Sec. 27-8-25w..Shut down 4,370 ft.

GRANT COUNTY

McKenna et al's No. 1 Sullivan, NE cor. Sec. 12-29-38w..Drlg. 2,125 ft.

GREENWOOD COUNTY

Staats et al's No. 1 Swan, NE NW Sec. 3-25-12.....Rig.
F. Konkay et al's No. 1 Rock, NW NE NE Sec. 7-27-12..Shut down 1,836 ft.

HARPER COUNTY

Atkinson et al's No. 1 Misak, SE cor. Sec. 25-34-6w.....Rigging up standard tools 4,635 ft.
Beeler et al's No. 1 Bear, C NE Sec. 21-31-6w.....Shut down 1,830 ft.

KINGMAN COUNTY

Skelly Oil's No. 1 Miles, NE cor. Sec. 30-27-10w.....1,635-40 ft. 2,000,000 ft. gas; at 2,005-20 ft. 6,000,000 ft. gas; shut down.

KIOWA COUNTY

Phillips-Prairie's No. 1 Bean, NE SE Sec. 10-30-17w....Drlg. 4,657 ft.
McKenna et al's No. 1 Ralston, C NE Sec. 14-28-20w....Rig.

LYONS COUNTY

Griffith et al's No. 1 King, NW cor. Sec. 8-19-10.....Shut down 910 ft.

MARION COUNTY

Aladdin Pet.'s No. 1 Koch, NW NE Sec. 36-17-3.....Rig.
Midwell's No. 1 La Master, NW cor. Sec. 31-22-4.....Rig on ground.
Magnolia Pet. Co.'s No. 1 Davis, SE NW Sec. 18-21-2....Silicious lime 3,435-43 ft.; water; abandoned.
Marshall et al's No. 1 Higgins, NE cor. Sec. 33-19-5.....Rig.

MARSHALL COUNTY

Swicker & Sincox's No. 1 Remple, C N half NW Sec. 22-4-9 .....Drlg. 1,395 ft.
Brazier et al's No. 1 Runkel, SE NW Sec. 13-2-6.....Shut down 50 ft.

McPHERSON COUNTY

United Pet. Co.'s No. 1 Kalgi, NE cor. Sec. 20-19-1w ....Location.
Henderson & Holden's No. 1 Sommerfield, NE SW Sec. 23-19-1w .....Spudding.
Aladdin Pet.'s No. 1 Rudolph, NW NE Sec. 36-18-3w....Spudding.
Slick et al's No. 1 Randell, C SW SW Sec. 35-17-5w....Shut down 50 ft.
Aladdin Pet. Co.'s No. 1 Larson, C NW Sec. 22-18-4w....Rig on ground.

MORTON COUNTY

Hydraulic Oil Co.'s No. 1 State Land, NW SE Sec. 22-24-43w .....Drlg. 3,250 ft.

MORRIS COUNTY

Urschell et al's No. 1 Bersuch, NW SE NW Sec. 10-17-7..Machine.
Pratt et al's No. 1 Whiting, NW SW SW Sec. 34-16-6...Shut down 2,600 ft.
Hankenson et al's No. 1 Cessman, SW SE Sec. 24-16-9..Rig.
Urschell et all's No. 1 Scott, NE NW Sec. 6-16-6.....Shut down 2,420 ft.

OSAGE COUNTY

Riggs & Smith's No. 1 Wood, SE NW Sec. 21-14-15.....Shut down 410 ft.

PAWNEE COUNTY

Phillips' No. 1 Cuthbertson, NE cor. Sec. 27-20-8w.....Fishing 2,785 ft.

PRATT COUNTY

Wilcox O. & G. Co.'s No. 1 Bappin, SW NW Sec 7-26-15w .....Fishing 4,353-95 ft.; water.

RAWLINS COUNTY

Danciger Oil & Ref.'s No. 1 Unknown, SW cor. Sec. 3-2-35w .....Drlg. 1,000 ft.

RENO COUNTY

Braden et al's No. 1 Thersen, SE NE Sec. 6-22-4w.....Shut down 3,380 ft.
Alco Royalty's No. 1 Kinney, SE cor. Sec. 16-22-7w.....Fishing 3,475 ft.
Shell Pet. Corp's No. 1 Popp, NW cor. Sec. 11-25-5w....Drlg. 3,515 ft. with water in hole.

RICE COUNTY

Streeter & Stearns' No. 1 Blake, NE NW Sec. 9-18-10w ..Location.
Muth Bros. No. 1 Beyers, NE NW Sec. 21-19-9w.....Drlg. 600 ft.
Jasper & Beschka's No. 1 Cupp, SW NE Sec. 22-18-9w..Drlg. 2,010-20 ft.; 7,500,000 ft. gas; drlg. 2,920 ft.
United Pet. Co.'s No. 1 Willman, NE cor. Sec. 29-21-9w..Drlg. 3,095 ft.
Tatlock et al's No. 1 Ploog, C SW SE Sec. 33-18-9w....Silicious lime 3,252-53 ft.; flowing 30 bbls. an hr. when shut in.

ROOKS COUNTY

Streeter-Stearns' No. 1 Conger, SE NW NE Sec. 16-10-16w .....Shut down 3,070 ft.

RUSH COUNTY

Prairie et al's No. 1 Lecker, NW SW SW Sec. 5-16-18w..Drlg. 3,550 ft.; show oil at 3,337-50 ft. which exhausted; drlg. 3,676 ft.
Syndicate Oil Co.'s No. 1 Lannen, C SW Sec. 11-18-16w..Drlg. 400 ft.

RUSSELL COUNTY

Empire Oil & Ref. Co.'s No. 1 Sherwood, SE NW NW Sec. 21-14-13w .....Drlg. 2,785 ft.
Austin Drlg. Co.'s No. 1 Rochfellow, SE cor. Sec. 6-13-13w .....Shut down 2,710 ft.
Gilbreath et al's No. 1 Bratton, C NE Sec. 33-11-13w....Shut down 2,155 ft.

SEDGWICK COUNTY

Streeter & Stearn's No. 1 Tobin, SW SE NE Sec. 5-22-2..Drlg. 640 ft.
Branson et al's No. 1 Kincaid, SE NW NW Sec. 4-28-1..Shut down 50 ft.
Buck et al's No. 1 McNananan, NE NW NW Sec. 2-29-1..Rig.

SALINE COUNTY

Sampson et al's No. 1 Sudenderf, NE SE Sec. 30-14-2w....Rig on ground.
Twin Mounds Oil Co.'s No. 1 Weis, C W half NE NW Sec. 30-13-4w.....Shut down 2,500 ft.

STAFFORD COUNTY

Boucher Oil's No. 1 Groves, NE cor. Sec. 9-22-11w.....Silicious lime 3,542-85 ft.; water; abandoned.

STEVENS COUNTY

Argus Gas' No. 2 Ponder, C NW Sec. 10-32-38w .....Drlg. 2,401 ft.
Western Prod. Co.'s No. 1 Ponder, C NE Sec. 10-32-38w..Drlg. 2,695 ft.
Western Prod. Co.'s No. 4 Fee, C NE Sec. 6-33-36w.....Drlg. 2,618 ft.
Braden et al's No. 1 Theisen, SE NE Sec. 6-32-4w.....Rig on ground.
McNabb and Mid-Kansas' No. 1 Rhinehart, C NE Sec. 23-32-39w .....Rig.

SEWARD COUNTY

Liberal Gas' No. 1 C N half NE Sec. 4-35-34w.....Shut down 2,600 ft.

SUMNER COUNTY

Magnolia Pet. Co.'s No. 1 Shriver, NW SW Sec. 9-33-2 ....Drlg. 3,660 ft.
Disney et al's No. 1 Fay, C E half SE Sec. 14-34-1w....Rig.
Davidson et al's No. 1 Strickland, SW cor. SE Sec. 12-35-1w .....Rig.

WASHINGTON COUNTY

Sincox et al's No. 1 Penwell, NW SE NE Sec. 16-3-3 .....Drlg. 1,570 ft.

WILDCAT OPERATIONS IN OKLAHOMA

(Continued from Page 60)

HARMON COUNTY

Harmon-Tex Oil Co.'s No. 1 Hoadley, NE cor. Sec. 17-4-24w .....Drlg. 2,593 ft.
S. M. Stauffer's No. 1 Castleman, SW NE Sec. 8-4-26w..Shut down 625 ft.

HARPER COUNTY

Empire's No. 1 Bruce, C NE SW Sec. 12-25-20w.....Shut down 7,195 ft.
Sinclair Oil & Gas Co.'s No. 1 Howell, C SW SW Sec. 14-26-24w .....20,000,000 ft. gas 5,350-5,400 ft.; total depth 5,539 ft.; shut down; sprayed 50 bbls. gasoline.

HASKELL COUNTY

I. T. I. O.'s No. 1 Blake, SW NW Sec. 3-10-21.....Drlg. 3,075 ft.
Mid-Western's No. 1 Poister, C NE SE Sec. 33-10-22....Shut down 4,297 ft.
Holden's No. 1 Phillip, SE cor. Sec. 3-9-18e.....Shut down 1,860 ft.
Marion Oil's No. 1 Sanders, NW NE NW Sec. 10-9-18e Shut down 2,337 ft.
Sanboise Gas' No. 1 Unknown, SW NW SE Sec. 32-9-21e..Shut down 2,100 ft.

HUGHES COUNTY

Wright et al's No. 1 Ott, SE SW Sec. 15-5-11.....Shut down 1,645 ft.
Irwin et al's No. 1 Jones, SE NW Sec. 30-5-10.....Shut down 4,270 ft.; cmtd. 6-in.

(Continued on Next Page)

For PURIFYING oil refinery gases

The purifying of oil refinery still gases, under high pressure and with high Sulphur content, has been successfully accomplished with the Koppers Liquid Purification Processes. The Illinois-Missouri Pipe Line Company plant, illustrated, has a daily capacity of 6,000,000 cu. ft. of gas per day, the gas containing 1000 Gr. of H_2S per 100 cu. ft., at 50 to 80 pounds pressure.

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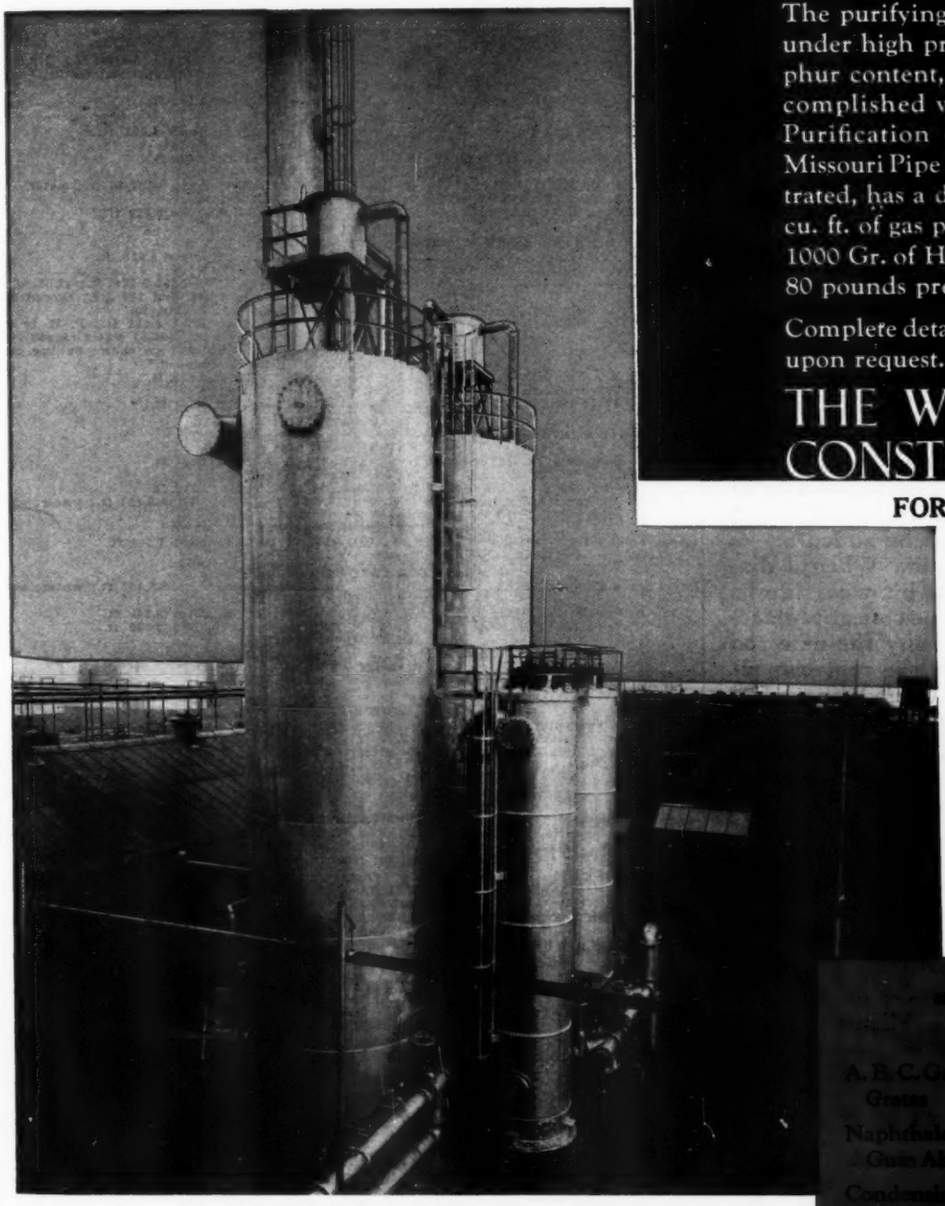
FORT WAYNE, IND.



Purification Plant of the Illinois-Missouri Pipe Line Company at Wood River, Ill. 6,000,000 cubic feet of Refinery Still Gas purified daily.

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Condensing Apparatus	Oxide Boxes (Purifiers)
Carburetted Water Gas Plants	Welded Steel Pipe
Blue Water Gas Plants	Tower and Rotary Scrubbers
Gas Dehydration Plants	Valves

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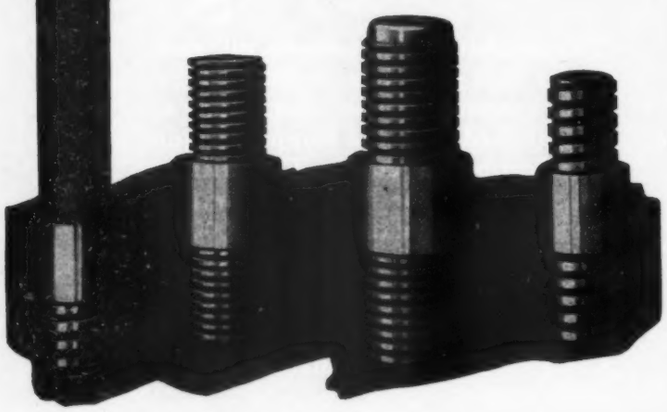

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KAY COUNTY

Peters & Buckles' No. 1 Hayes, NW NE NW Sec. 24-28-3 ..... Rig.
Mummert Drlg. Co. et al's No. 1 Cormick, C NW SE Sec. 9-27-2 ..... Rig.
Blackwell Oil & Gas Co.'s No. 1 Harshman, Sec. 2-26-1w. Rig on ground.
Boucher Oil Co.'s No. 1 Jefferson, NE SW Sec. 32-26-1w. Shut down 1,175 ft.
Blankinship Petroleum Co.'s No. 1 Hansen, SW NW SW Sec. 17-27-2 ..... Sand 3,590-97 ft.; swabbed 24 bbls. after 40-qt. shot; flowed 34 bbls. and shut down; pumping 30 bbls.

KINGFISHER COUNTY

Prairie and Slick's No. 1 Wright, C NW SW Sec. 23-15-5w ..... Drlg. 6,000 ft.
Galt Brown's No. 1 Wolf, NW SE Sec. 6-16-7w..... Drlg. 6,870 ft.

KIOWA COUNTY

Riley et al's No. 1 Grebb, SW NE Sec. 6-7-16w..... Shut down 1,135 ft.

LEFLORE COUNTY

Red Bank Oil Co.'s No. 1 fee, SE SW NW Sec. 23-9-24.. Wilcox 6,128-6,298 ft.; plugged back to 5,426 ft. to save gas.

LATTIMER COUNTY

LeFlore Oil Co.'s No. 1 McBee, NW cor. Sec. 2-7-21.... Shut down 3,601 ft.
Mid-Western's No. 1 Morris, C NW SE Sec. 12-6-21..... 1,662-1,650 ft.; dry; shut down 2,050 ft.
Limestone Oil & Gas Co.'s No. 1 Murray, NE cor. Sec. 25-5-18 ..... Drlg. 2,700 ft.

LINCOLN COUNTY

Atlantic Oil Prod. Co.'s No. 1 Parker, SE NW Sec. 5-14-6 ..... Wilcox 4,595-98 ft.; dry; second Wilcox 4,655-75 ft.; hole full water; abandoned.
Mote et al's No. 1 Stafford, NW NE Sec. 32-17-4 ..... Location.

LOGAN COUNTY

Slick and Ramsey's No. 1 Jones, SE NW Sec. 24-17-2w.. Drlg. 5,305 ft.
Eason Oil Co.'s No. 1 Young, C SW NE SW Sec. 34-17-4w. Sand 4,919-42 ft.; made 870 bbls. 21 hrs. and 485 bbls. 24 hrs. the second 24 hrs.

McINTOSH COUNTY

Patterson, et al's No. 1 Smith, SW cor. NW SE Sec. 32-9-16 ..... Shot 240 qts. 5,446-5,559 ft.; shot went off up hole; fishing.

McCLAIN COUNTY

Prairie's No. 1 Parkinson, SW NW Sec. 22-7-2w..... Drlg. 4,515 ft.

MUSKOGEE COUNTY

Sioux Oil Co.'s No. 1 Unknown, NW SE Sec. 21-11-19.... Shut down 1,011 ft.

NOBLE COUNTY

Barnsdall's No. 1 Miksch, NW SW Sec. 12-21-1..... Drlg. 2,470 ft.

OKFUSKEE COUNTY

Henry Oil Co.'s No. 1 Harjo, Sec. 36-12-9..... Shut down 4,127-57 ft.; water.
E. L. Robinson's No. 1 Rice, NW Sec. 2-10-9..... Location.
Shepard et al's No. 1 Nevens, SE NW SW Sec. 3-12-10.. Shut down 3,690 ft.

OKLAHOMA COUNTY

L. C. Hivick's No. 1 Sunset Addition, NW SW NW Sec. 17-11-3w ..... Shut down 5,515 ft.
Mid-Kansas Oil & Gas Co.'s No. 1 Messer, SW cor. Sec. 32-14-3w ..... Wilcox 6,697-6,771 ft.; shot with 90 qts. and 140 qts.; flowed 452 bbls.; shut in.
Prairie and Slick's No. 1 Dill, SE NW Sec. 17-13-3w.. Shut down 6,821 ft.; P. B. to 6,530 ft.; bailed water ripped csg. 5,810 ft.; no show; pulling csg. abandoned.
Warr et al's No. 1 Castle, SW NW Sec. 20-11-3w..... Drlg. 6,632 ft.
J. F. Cuniff, trustee's No. 1 Church Land, NE SW SE Sec. 17-12-4w ..... Drlg. 6,700 ft.

OSAGE COUNTY

Millard & Stanley's No. 1, SE SW Sec. 4-28-7 ..... Rig.

PAWNEE COUNTY

Morgan & Flynn's No. 1 Freeman, NW cor. Sec. 1-20-5.. Drlg. 3,460 ft.
Sperry et al's No. 1 Mullrap, SE SW Sec. 2-22-5..... Rig.
L. E. Wentz' No. 1 G. Lilly, SE SW NE Sec. 26-22-3... Drlg. 2,912 ft.
Flynn & Morgan's No. 1 Jones, SW NE Sec. 22-20-5..... Wilcox 3,794-3,824 ft.; water; abd.
Cochran et al's No. 1 Green, NE cor. SW Sec. 15-23-5... Rig.

PITTSBURG COUNTY

Apex et al's No. 1 Walker, NW SE Sec. 18-7-13..... Abandoned 1,600 ft.
C. Canady's No. 1 Jones, NW cor. Sec. 14-8-14..... Rig.

POTTAWATOMIE COUNTY

The Texas Company's No. 1 Knight, SW SE Sec. 3-8-3... Wilcox 5,395-5,407 ft.; water; abd.

ROGER MILLS COUNTY

Bucy & Stone's No. 1 Williams, C SW Sec. 23-12-24w.... Shut down 2,245 ft.
L. C. Hivick's No. 1 Davis, C NW NE Sec. 4-11-26w.... Shut down 2,995 ft.

SEMINOLE COUNTY

Sunray Oil Co.'s No. 1 Sunday, NW SE Sec. 35-5-5..... Location.

WASHITA COUNTY

Petroleum Holdings, Inc.'s No. 1 Musie, NW cor. Sec. 10-9-20w ..... Shut down 280 ft.

WOODS COUNTY

Gypsy-Prairie et al's No. 1 Thompson, SE cor. SW Sec. 10-25-15w ..... Shut down 6,104 ft.
Sinclair Oil & Gas Co.'s No. 1 Showwalter, C SW SW Sec. 33-27-16w ..... T. D. 7,280 ft.; plugged back to 6,730 ft.; shot 30 qts. 6,695-95 ft.; no results; plugged back to 4,885 ft. to test.

WOODWARD COUNTY

Farrond et al's No. 1 Unknown, SE cor. SW SE Sec. 2-22-17w ..... Shut down 1,387 ft.
Prairie Oil & Gas Co. et al's No. 1 Wilbur, NE cor. NW Sec. 32-23-17w ..... Shut down 7,445 ft.

OKLAHOMA PANHANDLE

CIMARRON COUNTY

Magnolia's No. 1 School Land, C SW NE Sec. 27-5-5..... Drlg. 4,740 ft.

TEXAS COUNTY

Argus Prod. Co.'s No. 1 Fischer, C NW Sec. 29-6-14..... Location.
Three Way Oil Co.'s No. 1 Crane, SW NW Sec. 11-1-1s ..... Shut down 4,425 ft.
Palo Alto Oil Co.'s No. 1 Graves, NE SW SW Sec. 23-2-1se ..... Spudded; shut down.

SOUTHERN OKLAHOMA

ATOKA COUNTY

Brookshire's No. 1 R. W. Rowland, NW NE NE Sec. 18-3s-10 ..... Drlg. 375 ft.

BRYAN COUNTY

Bryan County Oil's No. 1 Childs, NW SE SW Sec. 7-7-10.. Shut down 425 ft.
Bush et al's No. 1 Commerce Trust, NE cor. Sec. 35-6s-9 ..... Shut down 525 ft.
Johnson's et al's No. 1 Ussery, SE SW SE Sec. 14-16s-7e.. Shut down 485 ft.
Marshall's No. 2 fee, C SW NW Sec. 26-5s-7 ..... Shut down; 6-in. csg. 385 ft.

CARTER COUNTY

Campen-Lasater Co.'s No. 1 Anderson, NE cor. SE NE SE Sec. 32-4s-2 ..... Drlg. by casing 2,590 ft.

COTTON COUNTY

H. J. Dillard's No. 1 McMillan, SE NW Sec. 2-4s-13w... Abandoned 2,705 ft.

LOVE COUNTY

Hobbs et al's No. 1 Roberts, NE cor. SW Sec. 20-6s-3w.. Shut down 3,130 ft.

MARSHALL COUNTY

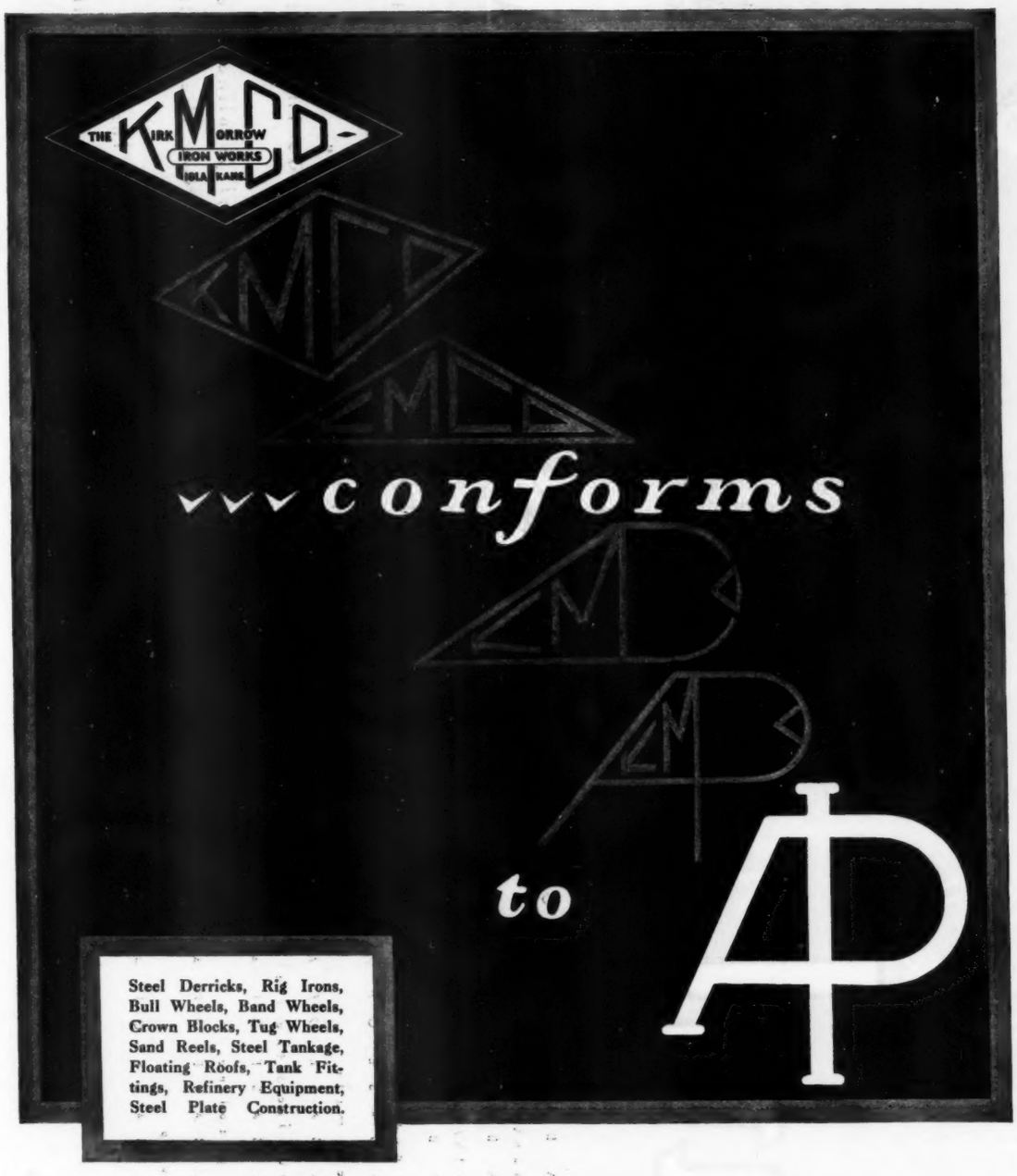
D. H. Curry's No. 1 Ward, NE SE SW Sec. 15-5s-6..... Drlg. 740 ft.
Keiner Oil's No. 1 Barnard, NW NE SW Sec. 28-5s-6e... Drlg. 1,230 ft.
McCrory et al's No. 1 Adams, NE SW SE Sec. 31-7s-6... Rig.
Akers et al's No. 1 Spicer, SW SE SE Sec. 33-5s-7e... Shut down 370 ft.

McCURTAIN COUNTY

Milton et al's No. 1 Vase, SW NW Sec. 26-6s-21..... Shut down 2,287 ft.

STEPHENS COUNTY

Obermyer et al's No. 1 Skelton, NE SW SW Sec. 32-15-7w ..... Shut down 1,375 ft.
R. Southard's No. 1 McKinney, NE cor. Sec. 25-1-8n... Shut down 1,060 ft.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FLUE GAS USED FOR REDUCING FIRE HAZARD

(Continued from Page 132)

rosion every three months, and the purger is used to gas-free them after shutting down and air-free them before starting up. Each holder has its own permanent generator, which is also used to wash the gas lines and the gas recovery plants.

A number of our towers are operated under vacuum. When shutting the plants down, the vacuum is broken with flue gas, thus removing the hazard of air entering, as well as effecting a time saving and eliminating the use of steam for this purpose.

For many of the applications of flue gas outlined above steam was formerly used. Steam for this purpose is costly compared to flue gas, and is not certain. It is well established that a temperature of at least 170° F. must be obtained when using steam before the container is reasonably safe. Condensation rates are high, and the danger of vacuums forming in event of steam failure must be considered. The removal of condensate is also to be considered. For example, in steaming out a fractionating tower the condensate collects on trays and gives trouble when starting up again. Last year a prominent company lost a large tower due to the sudden vaporization of water when hot oil was started in. A number of towers have experienced serious accidents due to this cause, as well as the ever-present chance of explosions on starting up or shutting down. Steaming of tanks sets up temperature stresses that the tanks are not designed to stand, resulting in many leaks at joints and rivets, which would not occur if flue gas were used. From an economical standpoint alone, the advantage of the use of flue gas as compared to steam is obvious.

Miscellaneous Uses

Miscellaneous uses of the flue-gas system, which have proved advantageous and economical, are to replace steam as a smothering agent in enclosed high-pressure exchangers, pipe still header boxes, and closed trenches. We have such installations operating successfully, and plan an extensive installation during the ensuing year. The amount of steam used for such purposes at present is an appreciable expense item.

As tank ships are a part of refinery equipment in many instances, a description of such installations is of interest. The Standard Oil Company of California has done a great amount of work in the development of flue gas systems on steam-driven tankers, and has published complete data.

The Sun Oil Co., operating practically all Diesel tankers, has developed and installed on most of its ships a somewhat similar system, modified for Diesel engine use. Figure 2 shows diagrammatically the Diesel tanker system. The arrangement provides for the flue gas to be taken either from the boiler or the small generator. The boiler, when in port, is always run for the steam auxiliaries, and supplies the large amount of flue gas required to keep the oil tanks full of gas while pumping out. The generator is used when at sea to keep the tanks full of gas, replacing any loss by breathing. The tanks at all times are free of air. This is accomplished by having the tanks filled with flue gas before loading is started and by supplying flue gas to replace oil when pumping out. Connections also supply flue gas to the cofferdams, which have been found normally to have an explosive atmosphere due to small leaks and no circulation.

To use the system effectively, certain changes in conventional ship design are necessary. No ullage holes are used in hatches, the tanks being gauged through eight-inch standpipes. Correction for levels thus noted due to tank pressure is made by manometer readings. Six-inch eye ports with wipers are fitted in hatches for use in topping off tanks. An enameled scale and copper float secured to hatch trunk may thus be watched, and exact oil level noted. No breather valves or flue gas valves are fitted to individual tanks, all pressure and vacuum protection being concentrated at the masts. Each mast relief is capable of protecting the entire vessel. This relief consists of an oil seal with blow-off cover and an especially designed breather valve. A flame arrester is located at the mast outlet 45 feet from the deck. An emergency pressure relief device, for use in topping off, consists in a weighted ullage cover on each eight-inch standpipe. This is dogged down at sea when the protection is not required. A continuous drainage system at the low points of the gas lines eliminates difficulty with condensation, the drainage being carried to a small tank in the pump room. Control devices consist of a carbon dioxide indicator, an automatic shut-off valve, and pressure-vacuum alarms.

The flue gas system cannot be used in the pump room, as men must work there. This room is protected by an exhaust duct ventilating system operated by a blower located on deck. In case of fire in the pump room, a system of nine bottles of carbon dioxide is provided. The pull cord is located at the after bridge rail. In the event the carbon dioxide system is used, the pull cord also shuts off the ventilating system, thus allowing the carbon dioxide to smother the fire. Lighting of the pump room is effected by powerful lights located on deck, shining through dead lights. This removes all electrical wiring from the pump room, the pumps being steam turbine-driven centrifugals or of the reciprocating type.

The cost of a flue gas system for a 13,000-ton tanker, including the additional safeguards described, is approximately $10,000 installed.

The cost of a flue gas generator for refinery use is approximately $1,500, installation costs varying according to conditions.

Summing up, it has been demonstrated by results obtained on actual installations that the presence of explosive mixtures of oil vapors and air may be eliminated by three practical and economical methods. One of the three methods consists in the use of gas as an enrichment agent and as the displacement medium in tank breathing, eliminating the presence of air. The second, and least used method, consists in forced circulation of air through tanks containing small percentages of dissolved gas in heavy oils, to prevent the tank atmosphere exceeding the lower explosive limit. The third, and most widely applicable method, consists in the generation of flue gas and its use to purge air or oil vapors from various types of refinery equipment, including tank ships and barges.

EXPLAIN UNIFORMITY IN MEASURING DETONATION

(Continued from Page 124)

the state of progress in the development of instrumentation. The recent work on indicating devices referred to has consisted chiefly of the development of the "listening post" described by Mr. Horning in his paper a year ago[2] of improvements in means of measuring manifold depression, and of the further development of the bouncing pin indicator, including the incorporation into it of an instrument for obtaining a direct reading of the degree of detonation, as distinguished from the customary method of measuring the gas evolved in an electrolytic cell within a given time.

Reference Scale

Following the item of apparatus just discussed, the next essential to a uniform method of knock rating is a common scale of reference fuels. This second item has been settled upon in a tentative way by agreeing to use normal heptane and iso-octane (2, 2, 4-trimethyl pentane) as primary standards.[3] Mixtures of these two hydrocarbons form a scale of antiknock quality, the use of which

[2]Tenth Annual Meeting Proceedings, Amer. Pet. Inst., Page 32.

[3]Edgar, "Measurement of Knock Characteristics of Gasoline in Terms of a Standard Fuel," Ind. Eng. Chem. 19, 145 (1927); Edgar, "Detonation Specifications for Automotive Fuels," J. Soc. Automotive Eng., 20, 245 (1927); Campbell, Lovell and Boyd, "Detonation Characteristics of Some of the Fuels Suggested as Standards of Antiknock Quality," J. Soc. Automotive Eng., 26, 163 (1930).

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has been approved as recommended practice by the co-operative fuel research steering committee. By the plan adopted, the antiknock values of fuels are to be expressed in terms of octane number. Octane number has been defined to mean the percentage of iso-octane by volume in the mixture of iso-octane and normal heptane required to match the antiknock value of any given fuel. The chart, Figure 2, shows for one single-cylinder engine how octane number relates to permissible compression ratio, or to compression ratio for incipient knock. The numerical values of permissible compression ratio as related to octane number will vary with different engines, of course. Those presented in Figure 2 are only for the purpose of illustration.

The thought is not that those laboratories which already have a scale of antiknock quality should at once abandon it in favor of this new octane number scale at all, but rather that everyone should establish the relationship between his own scale and this one which is expressed in terms of octane numbers, in order that all investigators may be enabled to get on a common basis of reference, or that all may begin to talk a common language. It is recognized that, since the method and the conditions of test have a considerable influence upon the results obtained, determinations in terms of octane number may be only approximate for the present. But, when both a definite apparatus and a specific method of test shall have been settled upon, it is expected that this difficulty will be largely or altogether overcome.

An effort is also being made to provide secondary fuels of designated octane numbers, in order that uniform reference fuels may be available in amounts adequate for routine work. This plan involves obtaining and making generally available one stable gasoline of low antiknock quality and another of high. These two fuels would either be adjusted each to some definite octane number, or else the values that they happened to have would be designated in terms of octane numbers. Antiknock values corresponding to any desired octane number lying between those of the two secondary reference fuels could then be obtained by proper mixtures of the two. Putting this plan into effect has been delayed by the inability to find a suitable source of a stable gasoline that is good enough in antiknock quality to form the upper end of the scale.

Method

The third essential to a uniform method of knock rating, as mentioned at the outset, is a common procedure, or method of making measurements. With respect to this very important item, the subcommittee has recognized from the first that selection of the best procedure or method of measuring detonation should be made with the utmost care, and only on the basis of adequate co-operative tests. As a means of determining the suitability of the engine, two comprehensive series of co-operative tests have already been carried out on a number of fuels which covered a range of antiknock quality. In these tests a number of different methods were employed by each investigator, all under conditions as nearly uniform for each as they could well be made. The procedures employed were not chosen as those from which a selection would ultimately have to be made, but rather as a group of representative methods that were adapted for use in the development of a suitable engine and apparatus, which is the thing that has been the main objective of the work thus far.

The various methods that were employed in the co-operative tests which have been made in connection with the development of apparatus are enumerated in brief below.

Throttle Opening Methods

1. In which the point of incipient detonation was judged by ear, and the items recorded were: (a) Degrees of throttle opening, (b) manifold vacuum as indicated by manometer depression, and (c) horsepower developed.

2. In which the point of a "standard" degree of detonation was judged by the listening post and the items recorded were, as before: (a) Degrees of throttle opening, (b) manifold vacuum as indicated by manometer depression, and (c) horsepower developed.

Spark Advance Methods

1. In which the spark advance at incipient detonation was judged by ear.

2. In which the spark advance at a "standard" degree of detonation was judged by the listening post.

3. In which the spark advance for the point at which power just began to fall off was determined with the aid of a dynamometer.

Variable Compression Methods

1. In which the compression ratio was adjusted to the point of incipient detonation as judged by ear.

2. In which the compression ratio was adjusted to a "standard" degree of detonation as judged by the listening post.

3. In which the compression ratio was raised to the point at which power began to fall off as determined with a dynamometer.

Fuel-Matching Methods

1. In which the quantities (a) of benzol and (b) of lead tetraethyl that had to be added to a common reference fuel to make its antiknock quality equivalent to that of the fuel under test was determined with the aid of the listening post as an indicator.

2. In which the same points as in (1) were determined with the aid of the bouncing pin indicator.

3. In which the same points as in (1) were determined by varying compression ratio to the point of incipient detonation as judged by ear.

Although no definite decision on the specific procedure that should be selected has been made, nor can be made on the basis of the work done thus far, the results already obtained have indicated one point pretty definitely. This is that the highest degree of precision and the best agreement between different laboratories are obtained when the procedure involves the matching of fuels, or when it consists of the determination of antiknock quality by comparison with, or in terms of, some common reference fuel. The results of this work are thus in confirmation of the importance of the second essential item of a uniform method of measuring antiknock quality as enumerated at the outset, viz., a common reference fuel or scale of fuels.

Evaluation of Variables

As a means of placing the measurement of detonation on a firm foundation, the Bureau of Standards and each of the co-operating laboratories have been investigating the effects of the outstanding variables that may influence the measurement of detonation. These variables include such factors as speed, jacket temperature, compression ratio, spark timing, mixture ratio, fuel composition, intensity of detonation and atmospheric conditions. It is extremely important to have some specific knowledge of the way in which each of these variables affect detonation, because it has been found that certain of them may influence to a large degree the relative knock rating of one fuel with respect to another. Thus, a blend containing 40 per cent of benzine in gasoline may be found equivalent in tendency to knock to concentrations of lead tetraethyl in the same gasoline varying all the way from 3.4 to 7.0 cc. per gallon, depending upon what the setting of the spark is at the time the determination is made. Similarly variant results have been obtained also with different mixture ratios, and with different jacket temperatures.

These observations are especially significant in connection with methods of measuring knock, because fundamentally all methods are based upon a comparison with some reference fuel. Since the results of this comparison depend upon the conditions under which they are obtained, it is desirable that the specification covering the adjustment of these conditions be such as to reduce to a minimum the disturbing effect of engine variables. At the same time these conditions should correspond as closely as possible to those prevailing in actual practice on the road.

The investigation of the variables enu-

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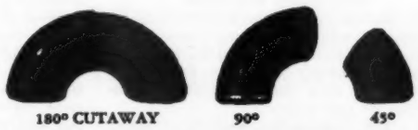

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Left: Cutaway 180° Tube-Turn, showing uniform thickness of walls—no thickening, thinning or buckling. Tube-Turns are made in 45°, 90° and 180° types—in sizes 1" through 18" Standard I.P.S. and 1½" through 12" Extra-Heavy I.P.S.

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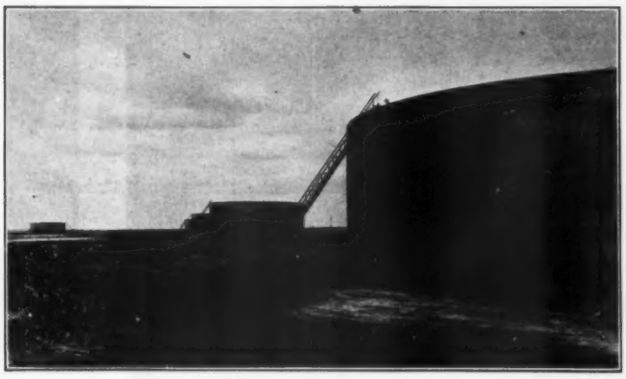

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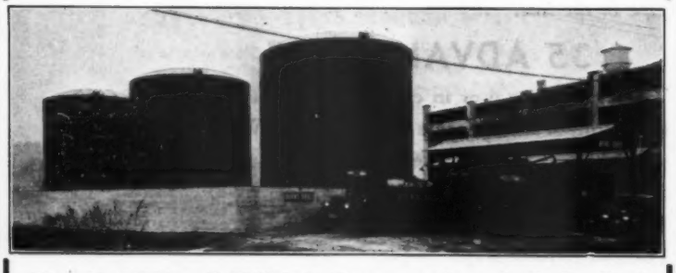

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merated above is being carried on under an organized plan by which each one of the outstanding variables will be investigated by at least two different laboratories. The results of some of this work have already appeared in the literature,[4] and a symposium in which the most recent developments will be discussed is being organized for the coming winter meeting of the Society of Automotive Engineers. It is expected that a large amount of valuable information will be presented at that time.

Co-operation Abroad

The subcommittee is fortunate in having the co-operation in this endeavor of a similar group in England. The British group is composed of the following key members: A. E. Dunstan of the Anglo-Persian Oil Co., F. H. Garner of the Anglo-American Oil Co. and J. Kewley of the Asiatic Petroleum Co. This group has appointed B. R. Jackson, who is located in New York as a representative of one of the British companies interested, as its representative on this side in order that through him they may contact as closely as possible the work of the American group. On the occasion of a trip which H. C. Dickinson made to Europe during the past summer, he represented our subcommittee by holding two meetings with the British group, during which he made them thoroughly conversant with the progress of the work on this side, and as a result of which he brought back to us in first-hand form the viewpoints of the co-operating members in England.

The importance of this international co-operation is two-fold. There is, first, the help that the British group will give in arriving at a sound method; and there is, second, the benefit of the comparability and interchangeability of data that will arise from the resulting universality of apparatus and method over a large portion of the world.

[4]Brooks, White and Allen, "Atmospheric Conditions and Knock Testing," J. Soc. Automotive Eng., 27, 56 (1930); Campbell, Lovell and Boyd, "Importance of Mixture Ratio in Rating Fuels for Knock," Ind. Eng. Chem., 20, 1045 (1928).

SAFETY MINDEDNESS IS PROFIT FACTOR

(Continued from Page 132)

theless, we find evidences on every hand that safety is on the march. The great and powerful American press is in arms against accidents; and I warn you that an industry involved in a serious accident carrying death to employes or clients is in for a hard time at the hands of the American press, if there is evidence that little or no constructive thought has been given to safety.

Five Safety Principles

In converting an unsafe marketing organization into a safe and, hence, more efficient one, at least five definite fundamental principles must be followed—though you vary the details of their execution as you will.

1. The responsible executive must, himself, be thoroughly sold; must recognize the value of safety effort, and be determined to improve conditions.

2. His recognition of the value of safety must be passed along and transmitted throughout the organization until every employe is reached.

3. The selection and appointment of a qualified safety man, whose entire time (assuming the organization is large enough to warrant it) is devoted to the promotion of safety, and the appointment of a safety committee, which acts as a reviewing body and court, to determine and carry out disciplinary penalties in cases of employes involved in avoidable accidents.

4. A continuous educational program directed at all employes.

5. The elimination, as far as humanly possible, of all physical and mechanical hazards through engineering and mechanical means.

All these five principal factors are important—but most important is the first: "The responsible executive must, himself, be thoroughly sold and recognize the value of safety effort." The supervisory force is ever profoundly influenced by the attitude of the executive management. The supervisor's actions are influenced, his thoughts colored, his decisions made, his efforts bent along lines his executive wants—meaning that when the executive wants action along safety lines, this will receive the support of the supervisory force.

Attitude of Executive

If you have, or believe you are having, difficulty selling "safety mindedness" to your supervisory force, look to yourself and make an honest analysis of your own attitude; find out if you have given your supervisors proper support; judge if your action and attitude have built up an atmosphere of sincerity regarding your interest in safety. Are you demanding safe operation as you demand production, quality, operating economy, and those other features which are part of successful marketing? As well expect salesmen who have no confidence in your products, who are not themselves sold, to make a success of selling your lines. You know it cannot be done. On the contrary, what an irresistible power is represented by a sales force thoroughly sold on the superior qualities of your products and the advantages of your own peculiar sales proposition.

Next in importance is the passing on—all along the line—of the executive's interest in, and enthusiasm for, a condition of safety mindedness, until the last man in the bottom job has been reached. It is not enough for the responsible executive to wish earnestly, by a cautionary warning occasionally, for a lower accident rate, both as regards number and severity. Among petroleum marketing organizations, where safety has been given thought, we have but to compare the results of this "desiring" kind of safety effort with results obtained when accident prevention has been made a highly organized activity, to realize the value of the latter.

Safety a Vital Subject

You cannot hope to get results if safety is something you talk about once in 12 months and then forget for a year. It must be made interesting. It must be kept vitally alive. It must be dramatized. "Breathes there man with soul so dead" to whom human drama has no appeal? Novelty or drama retains attention, makes definite impression—and these are essential. Novelty or drama should be used as much as possible in safety work.

Statistics—generally boresome and uninteresting—become living things when they prove, as has again and again been the case, that, in large operations such as public utility companies and the larger petroleum marketing organizations, the unflagging personal interest of the real "big boss" and the efforts toward safety inspired by him result in substantial reduction of accident frequency.

This type of executive has passed the point where he must be shown in advance, by statistics of compensation and medical cost, concurrent damage to equipment, interruption to service, loss of prestige and public good will, that safety is a real profit factor in marketing.

I have listed the appointment of a "safety man" as one of the five important steps, but real safety work does not cease, as far as the executive is concerned, by making such an appointment. He must evince a continued interest that compels a study of each accident, that brings forth suggestions for prevention, that locates responsibility and, if necessary, that causes the infliction of stern discipline where carelessness is involved.

The selection of a safety man and a committee functioning as reviewing body and court to determine disciplinary action against men guilty of violating safety instructions is important. There can be no doubt that safety work can be immeasurably advanced by more frequently invoking the administration of discipline for violations of safety instructions. We admit that we now chiefly inflict penalties where such violations result in accidents. In effect, therefore, we punish men only for the consequence of their faults, instead of for the faults themselves.

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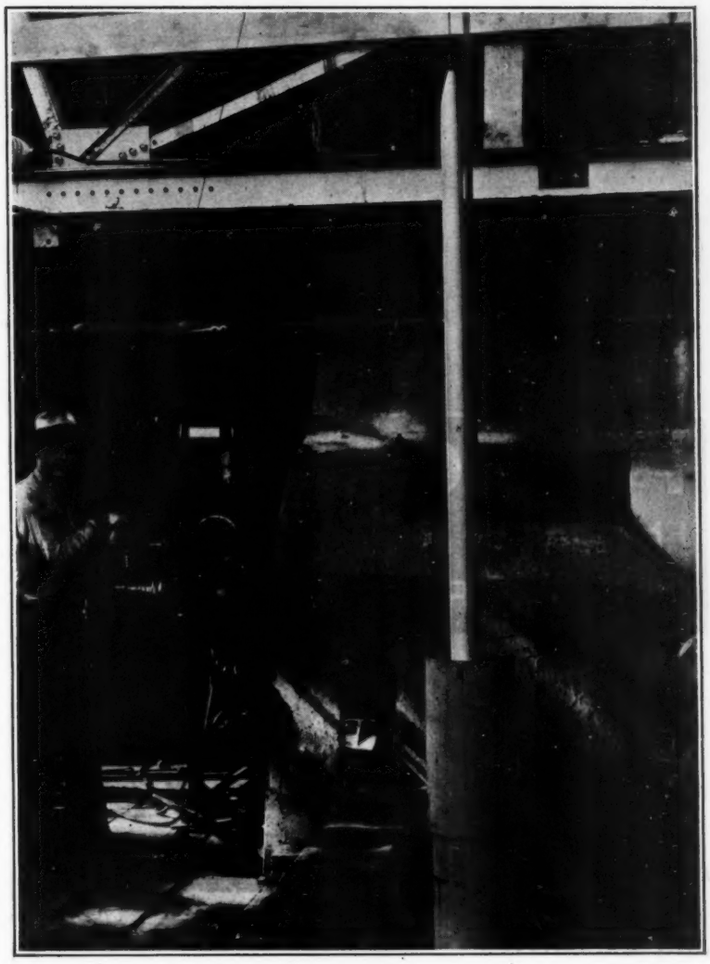

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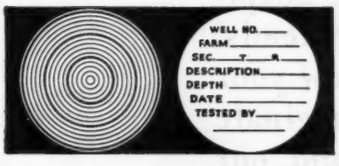

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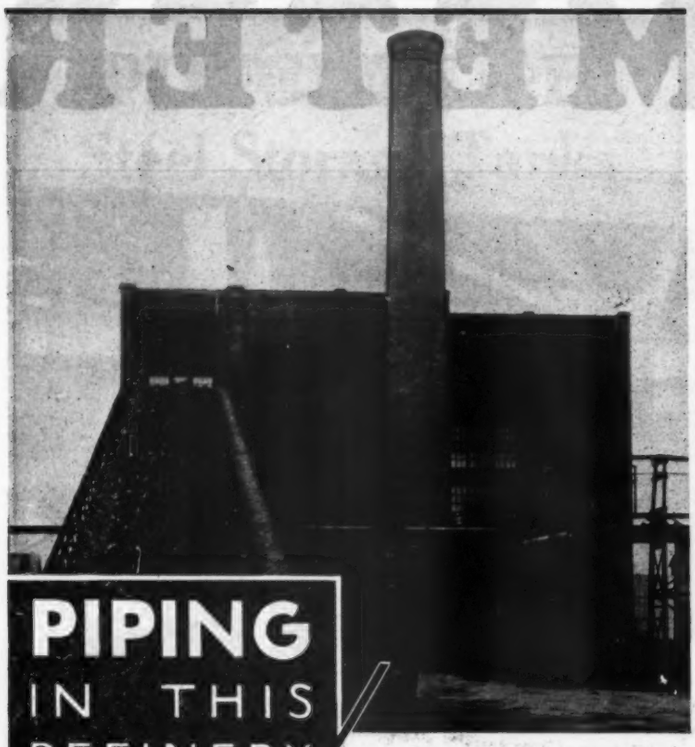

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This and above illustration show Lincoln Oil Refinery at Robinson, Ill., which installation was designed, fabricated and erected by Power Piping Co.

mit no compromise with rules and instructions pertaining to safety. Disciplinary penalties imposed will act as sharp reminders that such practices are unsafe and forbidden. The iron hand of discipline, clothed in the kid glove of salesmanship, is an ideal combination.

Concrete Examples

It is pertinent at this point to outline clearly, by a concrete example, how this can effectively be used. In New Jersey the state motor vehicle law provides that motor cars must stop before crossing a railroad at grade. Some time ago we became aware that our vehicles were observing this law and our rule, generally, in the breach. I sent a personalized letter to the home address of every driver of our motor vehicles, calling attention to our rule and the law. A little later a spot check at grade crossings proved that there was still considerable disregard of the rule. We then served notice on our men that violation would mean instant dismissal, and we took this drastic step in a few cases. There is now no longer any doubt in the minds of our men that we mean business and, as a result, our motor equipment now makes a dead stop before venturing upon a railroad grade crossing; hence we have practically assured ourselves that we shall have no more grade-crossing accidents.

The fourth important factor in this work which I had in mind was a continuous educational program directed toward all employes. Our approach is twofold—from the humanitarian and from the economic viewpoints. The idea will not stay sold like a tangible commodity. It must be resold to the same people currently, through education. Our first point of attack is to convince the employe that this is not something merely to benefit the employer, but is in his own interest in equal proportion at least. Now, what means shall we employ? Every possible means! No one alone will suffice. How shall we go about it? In every possible way! No one way will answer. One safety expert says "speeches"; another says "bulletins"; another "safety committees"; others pin their faith on meetings, dinners, group competitions, praise—blame; rewards—penalties; entertainments, motion pictures. None alone will do the job. Use them all or such as fit your case; but, above all, keep everlastingly at it.

The job of eliminating physical and mechanical hazards, which I have mentioned, need not be discussed here. The need for it is self-evident. The execution must fit each peculiar case.

Reduces Insurance Costs

It is recognized that a reduction in the number and severity of accidents in an organization is reflected in lower insurance costs, no matter how such insurance is carried. This is, however, by no means the largest saving. A few years ago the Travelers Insurance Co. analyzed 5,000 accident reports, drawn at random from their claim files. They found the amazing fact that the indirect cost of accidents is four times the direct or insurable costs. In these indirect costs, figure such factors as lost time of injured employe; time lost by other employes who stop work out of curiosity or to assist the injured one; time lost by foreman or superintendent in assisting the injured employe; preparing accident reports and attending hearings; damage to machinery or property resulting from the accident; interference with production and a long list of other factors.

We are justified in assuming that organized and well directed efforts to prevent or reduce accidents result not alone in lower insurance costs and corresponding reduction in hidden or indirect costs, but in increased organization efficiency, due to improved morale among the workers.

Moral Obligation

We recognize yet another reason for these efforts, and that is the moral obligation to do our part to prevent needless suffering.

Thirty-two years ago an undernourished, unprivileged, illiterate boy of 10 became a cog in the industry of New Jersey. The hours were long, the work monotonous and fatiguing. The machines, at one of which this "man" of 10 worked, were lined along the side of a long factory building. These machines were driven by a central power plant through the medium of a long shaft, high up on the wall, strung with pulleys and belted direct to each machine. There were no guards around these singing, swirling belts or pulleys. There were no guards around the grinding reduction gears alongside the pulley on each machine. There were no guards to prevent one of these children of labor slipping between the huge steam-heated cylinders and heavy upper roller which formed the heart of each machine. Worse than all—there was no sense of responsibility on the part of the management for the physical safety of the man; and when one day the boy saw hurtling to the floor the mangled body of a man, who had climbed a rickety ladder to replace an unruly belt on a revolving pulley, there was no compensation, voluntary or otherwise, for the incapacitated wreck who could never work again. Yes, thank God, there has been progress in these three fast-flying decades—when this great industry asks that boy to discuss before this gathering its responsibility for the physical safety and welfare of its employes and customers.

Gentlemen, I have no hesitancy in expressing the conviction that the petroleum marketing organizations represented here are agreed there is profit in safety, and for economic as well as moral reasons are ready to accept the responsibility implied in the question, "Where is Abel, thy brother?"

FLUE GAS USED IN PROTECTING TANKERS

(Continued from Page 136)

pair operations. This emphasizes the importance of thoroughly gas-freeing and cleaning ships before attempting repair or maintenance work. When such gas-freeing must be carried on in port, it is frequently neglected to save time. Because the flue gas system permits gas-freeing to be carried on at sea under any weather conditions, the captain is always in a position to bring his ship in in a wholly or partially cleaned and safe condition.

Operating Advantages

This matter of gas-freeing at sea is frequently an important operating advantage, as well as a safety feature. Another operating benefit that can be derived from the installation of a flue gas system is found in connection with the discharge of volatile cargoes such as casinghead gasoline. When handling such products, gas-binding of the pumps is quite common, slowing up the discharging rate, and occasionally making it impossible to empty the ship. Pressure may be applied on the surface of the oil with the flue gas system up to the safe maximum which the tanks will stand, thus aiding the pumps to fill on the suction stroke. This pressure is equivalent to an additional column of liquid, and is often sufficient to allow a ship to discharge at the normal rate where without the pressure the vacuum in the suction lines would create gas and delay the ship's operations a matter of several hours or even days.

Still another operating or economic advantage obtained through the use of flue gas systems is a reduction in the rate of corrosion of steel forming the walls and roofs of tanker compartments. A series of micrometer measurements of the rate at which metal is being corroded from the hatch covers of a number of compartments in a flue-gas equipped ship, extending over a period of three years, shows a substantially lower rate than similar measurements in a ship in comparable service but not equipped with flue gas until a few months ago. While experience is still too limited to draw any very general conclusions on this point, it appears possible that this reduction in rate of corrosion may be of enough importance to justify economically the installation of flue gas systems entirely regardless of their fire protective value.

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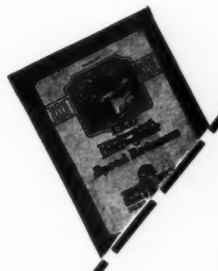

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volume of flue gas to displace the oil being pumped out in case that boiler is furnishing any considerable part of the steam required for such operations. The disadvantage in connection to more than one boiler is that valves must be furnished so that the branch lines may be cut off. On account of the heat and soot to which they are exposed, such valves frequently give trouble.

It has been found best to take the flue gas from the boiler breeching below the Howden heaters and to concentrate on the gas from a single furnace. In this way, contamination of the flue gas by air leakage or air currents descending through the stack can be largely avoided. If connection is made into the uptakes near the base of the stack, dilution of the flue gas with air has sometimes been found serious when the boiler is being fired light as in pumping out.

The steam ejectors have been found most successful for forcing flue gas into the tanks. Before these were used, various types of blowers were tried, but all gave trouble from the occasional soot or salt water which found its way into them. This material created a heavy scale, and frequent cleaning was found necessary.

In the steam lines which feed the ejectors are two pressure actuated diaphragm valves regulating the flow of steam. One of these is connected to the cooling water supply line, so that if the cooling water pressure fails, the steam to the ejectors will be cut off and flue gas will no longer be forced to the system. At the same time, a plug cock in the line just past the cooler is closed automatically. This is to prevent hot gas or possibly incandescent particles of soot finding their way through the system and into the cargo tanks in case the cooler does not function. The second regulator valve is actuated by the flue gas pressure in the main line to the deck and cargo system, and closes off the steam to the ejectors in case the pressure in the system rises above a predetermined value.

Gas Handling Capacity

The pumping rate of the ship's cargo pumps fixes the minimum gas handling capacity of the ejectors and flue gas system. In case provision is to be made for tank ventilation, the maximum capacity should be high so that displacement may be carried on rapidly. The "fresh air intake" on the suction side of the ejectors is for blowing the tanks out with air after ventilating with flue gas as described. This inlet is usually covered by a blank flange when not in use, and is provided with a screen to prevent debris from being sucked into the system.

It is important that the flue gas be cleaned thoroughly of soot, as this tends to settle out along the lines and in valves; and if left in in sufficient quantity, will produce a persistent fog or smoke in the tanks. Sulphur dioxide is present in practically all flue gas to greater or less extent, and must be washed out. The gases entering the cooler at around 400° F. must be cooled to about air temperature. Any washer or cooler used must be designed so that the gases leaving it will not carry suspended salt water, as this will accumulate in the lines and valves causing stoppage and corrosion, and may even contaminate the cargo tanks. As much space as possible should be provided in the upper section, so that separation of suspended particles of salt water will be complete. Tests have shown that the cooler carries over practically no water in suspension even at the highest gas rates for which it is intended.

Action of Cooler

The action of this cooler might be described as that of a froth-type bubble tower. Gas arising from the bottom section strikes the lower plate and is conducted through the water reservoir to a dome which turns it back, forcing it through a perforated plate submerged in a pan of water and into the next gas space. This is repeated throughout the series of four plates. Water accumulates on the plates, and after washing the gas, flows through a downpipe onto the plate below. The gas is broken up into a mass of fine bubbles on these bubble plates, a large area of contract thus being formed. A pan or rim around the upper end of the downpipes which carry the water from plate to plate provides a funnel into which no gas is passing and where the water may separate from the gas, thus not carrying bubbles into the downpipes. Gas or air carried into downpipes or drains cuts down the effective capacity very materially.

In a test under operating conditions, it was found that this type of cooler took out around 98 per cent of the soot. In accomplishing this, sulphur dioxide is virtually eliminated and the gases are satisfactorily cooled. It was found that the bubble plate type of washer was more efficient and had less tendency to carry over salt water than the spray type.

On account of the restricted space ordinarily available on board ship, gravity drains for the cooling water must be carefully designed to avoid trouble. The cooler should be placed well above the water line, and the drain line should drop directly down, or at a steep angle as far as possible. A horizontal run just after the drain leaves the cooler should be avoided, and care should be taken that no air traps are formed anywhere in the piping.

Precautions Necessary

Since the flue gas system provides an interconnection between the vapor space of cargo tanks and combustion space of boilers, it is necessary to provide against escape of combustible vapor into the boilers, as well as to guard against sparks being carried into the cargo space. The cooler itself contains a permanent water seal which will extinguish sparks. It has a trapped entrance which prevents tank vapors from backing up into the boiler flues as long as there is water in it. While the ejectors are in operation, they supply another very effective blockade between the boilers and the tanks. If either the steam supply to the ejectors or water supply to the cooler should fail, the system is shut off by a quick closing valve. It consists of a lubricated plug cock operated by a steam ram receiving its steam supply from the same source as the ejectors. The steam supply to the ejectors is controlled by a diaphragm valve, so that if either it or the cooling water supply to the cooler should fail, the pressure in the steam ram is reduced until it is overcome by the springs which close the valve and thereby shut the entire system down automatically. Probably the most important function of the quick closing valve is to furnish protection against mistakes in operation which might, without it, leave the cargo tanks connected to the boiler flues when the ship is under way.

As a further operating safeguard against possible misadjustment of valves, etc., an alarm system for excessive pressure or vacuum is provided. A mercury manometer may make contact either on the pressure or vacuum side, closing a battery circuit which in turn operates a relay on the ship's regular 110-volt circuit. The 110-volt circuit is connected through an electric horn located in the engine room, thus giving a signal in case of excessive pressure or vacuum.

The lead to the manometer is taken from the main deck system forward of the after stop valve. In case the automatic valve closes down for reason of failure of cooling water, a vacuum will be created and the signal will blow. If, during discharging, the mast gate is accidentally left closed, pressure rises in the deck system and the alarm is sounded.

In the mast line and a pair of branch lines plug cocks are used in the system instead of valves. These cocks always allow a good positive shutoff, and have the advantage of not becoming jammed with accumulations of soot or scale. The crews find them simple to operate; and when painted a contrasting color, the handles indicate whether the cock is opened or closed from a considerable distance, even at night.

The equipment discussed might be termed the essential features necessary to the successful installation and operation of a flue gas system. However, our experience has demonstrated that a number

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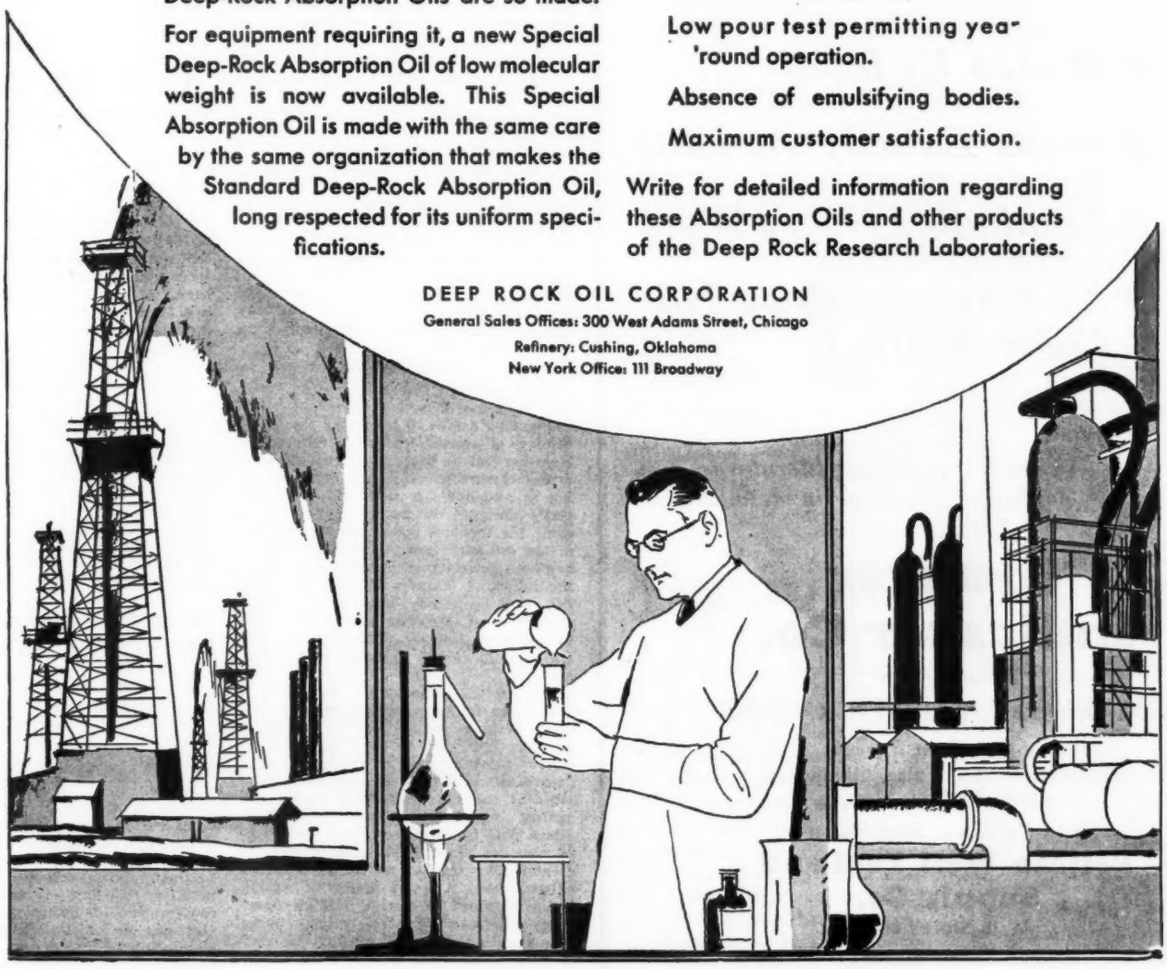

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of accessories will greatly increase the convenience, usefulness, and safety of flue gas installations.

Essential Requirements

It is essential in employing a flue gas system to keep inspection hatches or ullage plugs closed, and to maintain the tanks as nearly gas-tight as possible. This means that some method of determining the position of the oil height during both loading and discharging must be provided. A marine type float gauge, especially developed for this service, has been installed on some flue gas equipped ships. Through a window in the top of this gauge head a tape gives the correct outage or "ullage" reading at all times when the gauge is released for operation. The cast aluminum float is counterweighted, so that an even tension is kept on the tape and that it runs freely over the sheave in the gauge head. The counter-weight travels up and down in a pipe, or well, closed at the bottom and filled with a light lubricating oil. The pipe restrains the counter-weight as the ship rolls from side to side, while the oil contained in the tube serves to damp rapid movement or "running" of the tape with surging of the cargo and protects the tape against corrosion to a large extent. The float is guided by a pair of wires held taut by heavy springs located in the gauge housing. When not in use, the float may be reeled up and locked securely against the deck to protect it and the tape from the wash of the cargo.

The necessity of using this relatively elaborate gauge depends upon the service of the vessel on which it is being installed. Among the various alternative gauging methods, which have been tried with varying success, gauge wells have been found to be simple, and for a great many services quite satisfactory.

They usually consist of a fairly large diameter pipe, say 8-inch or 10-inch, extending from the deck to a point close to the bottom of the tank. Of course, the oil level in such a well will be much above the level in the main tank if it is under any large pressure, or below it if it is under vacuum. If the flue gas piping is large, the error in the gauging wells can be held to a moderate value. During loading, the error is on the side of safety, and disappears as the rate of loading is reduced. Besides pressure differential errors, variation in gravity of the oil loaded and accumulations of water in the bottom of tanks into which the well may dip contribute to the error involved in using gauge wells.

Breather Valves

Tank breather valves are not a part of the flue gas system, but the use of a flue gas system serves to bring out the shortcomings of unsatisfactory breather valves. Breather valves protect against the accidental closure of vent lines while pumping in and out. A valve has been specially designed in an attempt to overcome the troubles possessed by breathers of the ordinary type. This valve, which has been satisfactory in service, embraces the following features: Pop action, high lift, high capacity, noncorrosive material, ease of checking setting for both vacuum and pressure, good drainage, general sturdiness and tightness under pressure.

If, through accident or negligence, a tank were to be overfilled, the breather valve, designed for the flow of gas, might not carry off the stream of oil, and excessive stresses would be put on the tank accordingly. An emergency relief provided at the ullage hole is a good guard against such a mishap. The regular ullage plug is simply weighted with lead, so that its opening pressure is slightly greater than that at which the breather valves open. A lesser degree of protection is obtained by placing a single emergency relief of similar nature in the main flue gas line, but the venting capacity of such a relief is very limited on account of the size of the lines leading to it, they being designed for gas flow.

One of the questions which becomes important to the operators of a flue gas system is whether the mixture in tanks connected to such a system is really free from explosion hazard. In judging the suitability of flue gas for protection against the formation of explosive mixtures, carbon dioxide is the easiest constituent to test for. As a criterion, it varies with a variation in fuels, but with any given fuel it may safely be relied upon. In judging the safety of mixtures of flue gas and gasoline or oil vapor, where there is any doubt that the products of combustion sufficiently dilute the incidental air present, it is sometimes necessary to test for one other constituent in addition to carbon dioxide. Of the three other constituents ordinarily present—nitrogen, oxygen, and gasoline vapor—it is usually easiest and most convenient to test for the gasoline vapor.

A study of the data available indicates that when the carbon dioxide content is above about 5.4 per cent in any mixture containing petroleum vapor, air, and flue gas from a properly regulated oil fire, the mixture will never be explosive. To allow a factor of safety, our operating instructions require that the flue gas going to cargo tanks should contain at least 9 per cent carbon dioxide.

Diluting Oxygen

An oil which is volatile enough sufficiently to dilute the oxygen present with its own vapor may have a nonexplosive mixture above it without the presence of flue gas. If flue gas is added to such a mixture, the carbon dioxide content of the resulting mixture might be below 5.4 per cent, and the vapor space might still be nonexplosive. Hence. after the flue gas is mixed with gasoline vapor in the cargo tanks, judging the safety of the mixture from analysis may become a little more complicated. The chart shown was compiled (largely on the basis of the Bureau of Mines data summarized in Bulletin No. 279) so that results of tests for carbon dioxide and gasoline vapor might readily be interpreted.

The above discussion has been restricted to steam vessels. The exhaust from Diesel engines at best has too much oxygen to furnish dependable protection, since these engines run with considerable excess air. Fuel oil may be burned in donkey boilers to generate auxiliary steam, or in flue gas generators designed for this specific purpose to give flue gas of satisfactory quality. We understad that some special generators are now in successful operation on board ship. A barrel of fuel oil will supply sufficient gas of satisfactory composition to take the place of approximately 18,000 bbls. of oil as the vessel is being discharged.

At present all of Standard Oil Co. of Calif.'s large steam tankers (over 9,000 tons) are equipped with flue gas systems.

The Standard Oil Co. of California has prepared a brief statement of the flue gas system and distributed it among ship operators. To those who expressed interest, a general description, together with drawings, has been furnished gratis. When it is decided to build one or more of these systems, and the benefit of our experience is desired, a complete set of detailed plans is furnished at cost.

MEANING OF GASOLINE DISTILLATION CURVE

(Continued from Page 144)

starting curves may cross, and we have a condition in which vapor lock will occur, with any fuel on which the engine will start. Similarly, for a given automobile, the range narrows as the propane content of the gasoline increases.

It is clearly desirable, from the standpoint of the oil refiner and the general public, that as large as possible a fraction of the products of refining shall be available for automobile use, since this involves economy of manufacture, and conservation of natural resources. It is also just as clearly desirable from the standpoint of the automobile manufacturer that his product shall operate satisfactorily on as wide a range of fuel as possible.

The oil refiner may contribute his part to increasing the permissible range by eliminating propane from his gasoline; and should, of course, provide a fuel whose 10 per cent points will lie between such limits as may be satisfactory in a

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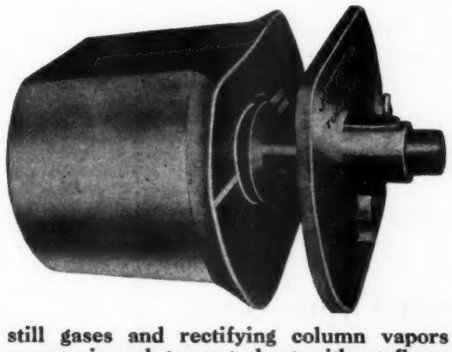

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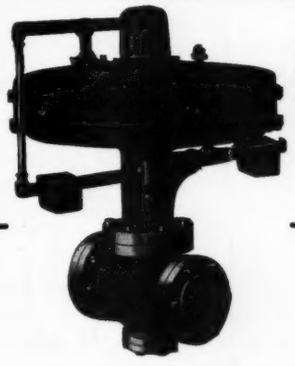

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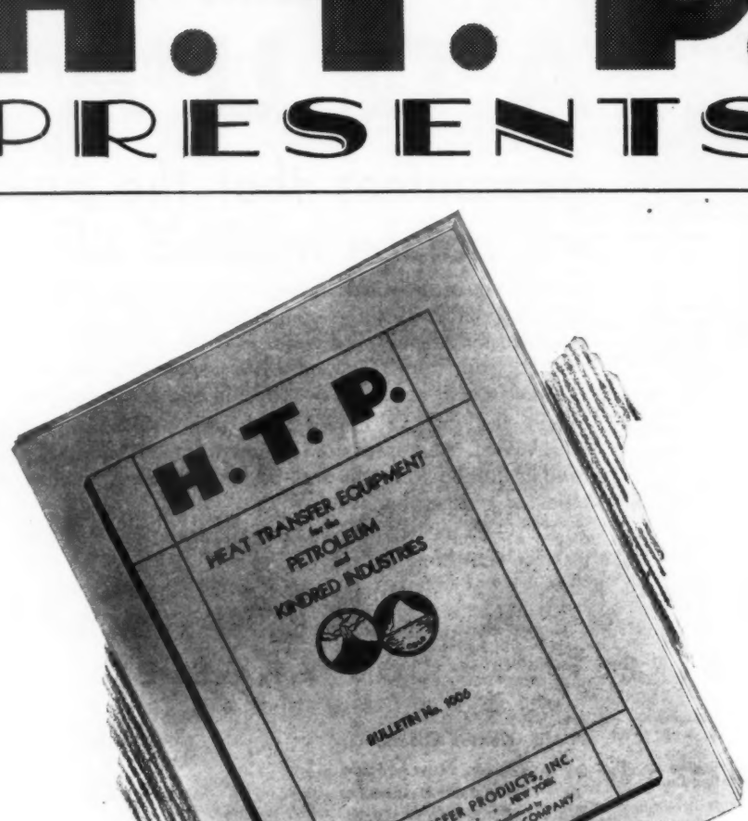

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reasonably well designed fuel system. The automobile manufacturer may contribute his part by providing an efficient choke, and by studying the temperatures reached in his fuel system and keeping them as low as possible by appropriate details of location, insulation, etc. "The cooler the fuel, the less trouble from vapor lock" is axiomatic.

Acceleration

Ease of acceleration is a more complex factor than those discussed above. It is related to points on the A.S.T.M. distillation curve [22 24 27 28] between the 10 per cent and 90 per cent points, depending on the type of engine and the conditions. In general, the relative acceleration characteristics of two fuels may be determined by comparing the temperatures at which certain percentages are evaporated in the A.S.T.M. test, the particular percentage being determined by the manifold temperature. The lower the manifold temperature, the lower the per cent evaporated to be selected for the comparison. The types of manifold and carburetor are also involved, and it may be noted that if it were possible to adjust the air-fuel ratio and accelerating charge for each individual fuel used, it would be possible to achieve essentially identical acceleration characteristics for the different fuels. It cannot be said that the data so far available constitute a complete answer to the problem, but they have resulted in the development of an important research tool, a portable accelerometer, by means of which the acceleration characteristics of different fuels in a given engine, or of a given fuel in an engine with different carburetor and manifold characteristics, may be studied. By the use of this instrument, the automotive engineer is enabled to determine the advantages and disadvantages, from the standpoint of acceleration, of different types of fuel induction systems, and the oil refiner may determine the performance of his fuels in engines of different types. Out of such researches may be expected to come improvements in the acceleration characteristics of fuel induction systems, and a clearer understanding of the relation thereto of fuel volatility.

Crankcase Dilution

The temperature of complete vaporization and the tendency to crankcase dilution are both determined by the 90 per cent [9 14] point on the A.S.T.M. distillation curve. Neither of these factors seem as critical in its significance as those previously discussed. From the 90 per cent point may be calculated the dew point of the gasoline, and hence the temperature at which a dry mixture is formed in the manifold for any given air-fuel mixture. Figure 4 illustrates these relationships. The abscissae are the A.S.T.M. temperatures for 90 per cent evaporated, and the ordinates are the minimum temperatures at which complete vaporization can occur. The various curves are for different air-fuel ratios supplied by the carburetor. For illustration, for a 12-1 air-fuel ratio, and for a fuel whose 90 per cent point is at 392° F., the manifold temperature must be at least 152° F. to form a dry mixture. The question of the relative effectiveness of wet and dry mixtures in engine performance is still a controversial one, and will not be discussed here. An abnormally high 90 per cent point produces excessive crankcase dilution, and it is evident that for this reason alone the 90 per cent point must be held within reasonable limits.

Fuel Economy

While the work outlined above has shown the importance of fuel volatility on starting, vapor lock, etc., it may be noted that preceding this work a statistical study of the performance of automobiles under road conditions indicates [1 3] that the effect of volatility on fuel economy is a relatively minor one, and is of a much smaller magnitude than the effect on economy which may be produced by careful control of the air-fuel ratio.

"Initial" and "Endpoint"

It should be pointed out that the various investigations carried out on the volatility of fuels have shown conclusively that neither the initial nor the final distillation temperature, or endpoint, has any significant relation to the engine performance of a fuel; and it is highly desirable that these terms should pass into disuse.

Conclusions

It cannot be emphasized too strongly that the relation of fuel volatility to engine performance is a mutual problem, involving the co-operation of the automotive engineer and the oil refiner. A sound technical basis is now available for such co-operation. The automotive engineer can help the refiner and the public by increasing the range of fuels on which his engines will operate, and thus make available a larger fraction of the available crude oil, and permit lower refining costs. The oil refiner, on the other hand, must co-operate in providing a fuel which will operate satisfactorily over as wide a range of conditions as possible in an engine of at least reasonably good design. The fundamental principles by which these results may be accomplished are now largely available, and are outlined in this paper. It remains only for those responsible for the progress of both industries to see to it that these principles are applied, and that the intelligent study of the last few years is continued and expanded.

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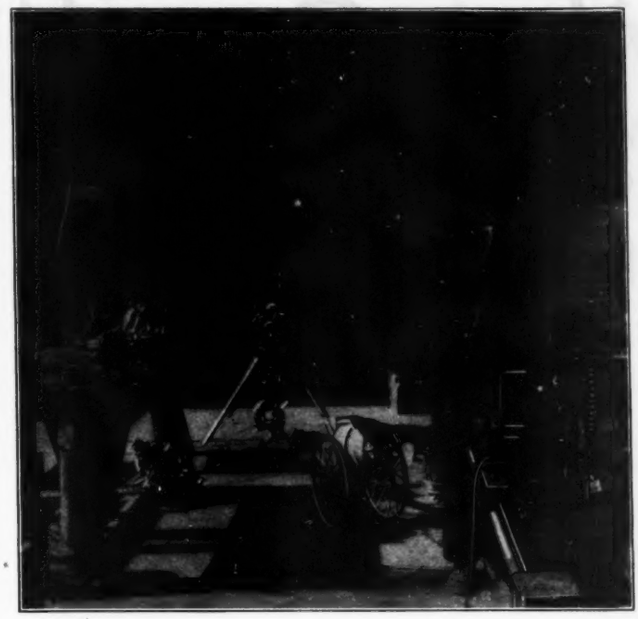
UNITIZATION LAND AND LEASE ASPECTS

(Continued from Page 148)

nite nature as to reflect favorably on some particular portion of the block. The partnership, consequently, having paid for the benefits of the test, should remain intact until all leases in the block are disposed of by joint release or by



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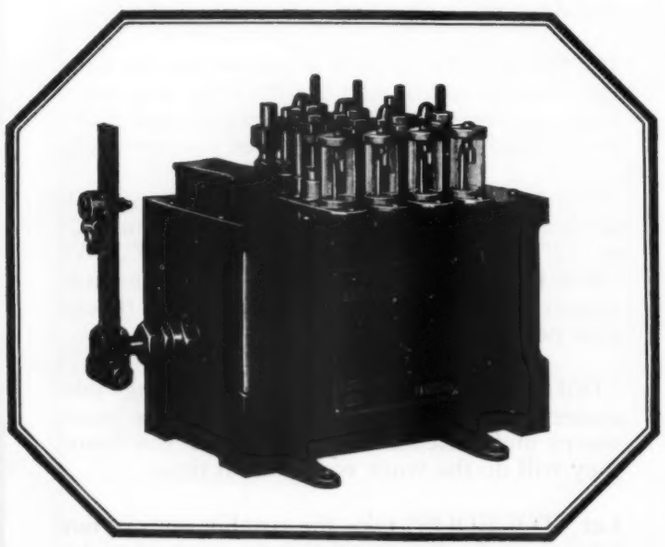

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individual withdrawals. It seems that the latter standpoint, in view of cases of production later developed on dissolved pooled acreage, is far more sound and consonant with true equity. Another somewhat debated point is: "What may be considered as individual purchase of leases or royalty in the vicinity of the unit operation? And what should be considered a partnership acquisition?" The expediencies of leasing often require sudden decisions and quick purchases, and individual action must be taken. Such cases have no set rules. However, the principle may well hold that individual purchases, whether royalty or lease, by a partner in an area reflected on by unit operation should always be offered to the other unit holders, each partner being allowed to participate up to his proportion and the originator absorbing the proportion rejected by any of the partners.

Just what lease or royalty may be classified as "reflected on" would have to be established by local conditions. Probably this principle may become even more complicated and controversial where concerns own subsidiary royalty investment companies, or where the rules of a company permit its employes latitude for royalty investments. There is no doubt that fear of limitation of its own activities, or those of its employes or affiliated companies, has had its deterring influence in securing hearty endorsement by some concerns of unit operations.

Small Operator Benefits

There has been one deceptive fear that has kept this movement from the success it deserves. The smaller operator has sometimes felt that in unit operation there is a loss of individuality and the personal protection that he has always jealously guarded. A study of actual examples will prove that such is not the case; instead, unit operation is the real salvation of the marginal operators through increased earnings from these projects. Under fractional interests, his smaller purse may be more broadly applied to diversify his investments; while the division of burden will lighten the enormous expenditures demanded in outlays for modern deep drilling and expenses of continuous development.

True, for all of us, the oil "game" is over, but in the oil industry the opportunities of each are enhanced.

Disagreements, up to this stage of the development of unit operation, have been decided by mutual adjustments; but in a broader application of this type of operation it can be expected that matters involving principles will, from time to time, come into dissension. In anticipation of such occasions, along with standard contracts and also standard usage, it would be extremely timely for the committee of the American Petroleum Institue studying unit operation to define and secure a membership sanction of certain general principles to apply to such usages. It is probable that, as an outgrowth of such a move, this committee, or a subcommittee thereof, may ultimately evolve to function as an informal umpire as between partners in disputes on question of such principles.

Future Expansion

No picture of unit operation would be quite complete without a sketch of its prospects in future expansions. With the sound fundamental legal and practical basis of partnership to build on, there is no inherent limit of size, area or number of partners, to inhibit the expansion and application of this form of development. Just as with any growth that is sound, whether it be buildings that tower towards the 100-story mark or wells that are even now planning depths that reach to 10,000 feet, we may expect unit operation, which now merely contemplates the grouping of a few leases, to grow into co-operative efforts that will scientifically explore and test larger and larger areas with increasing numbers of partners in such projects. There are certain fundamentals, however, that must be recognized and that must become a part of the fabric of such large unit operation to insure its popularity. The principle of distribution of responsibility and management of various phases of these projects must be inaugurated; some distribution of the geological, leasing and title work, drilling, operating, pipe lining, and marketing duties must be worked out so that partners in the larger unit projects may have actual participation in the work of these projects with which to occupy parts of their own particular organizations. Such division of duty would not appreciably increase overhead, but would serve to reconcile many now reluctant to co-operate in an endorsement and application of the practice. The principle of equality of opportunity of each of the partners to profit by the collateral investments in royalty, or additional leases, must be sedulously protected, and the highest of ethical standards maintained in both the letter and spirit of these agreements. Unit operation is gradually building its own by-laws of procedure in these matters, but those who have the trusteeship in such operations now being conducted should lay the foundation stones of future traditions of administration and interpretation in the broadest spirit of fair play. They must pioneer not only the principles that are proving to the industry at large that unit operation is the most soundly profitable form of development, but also that under this form of exploration the individual operator has a greater opportunity to prosper and build the larger success in business to which he is entitled.

The time has come for the lessons of experience to be reduced from informal precedents into a group of definitely set out obligations and enunciated principles upon which the future may be built with uniform standards. This task of providing the mechanics of standard contracts and accounting. and of establishing the equities of conduct to govern the usages as between unit partners, is one to which the American Petroleum Institute should lend the sanction of its prestige.

MANUAL OF SAFETY PRACTICE FOR FIRE

(Continued from Page 140)

oil companies operating in the United States are practically the same—modified, of course, by the variety of products and the extent of their business; but, generally speaking, the risk to life and property is much the same irrespective of location or the size of the company. It is most fortunate for the industry that such a degree of immunity from fire hazards exists, as apparently obtains today throughout this country. This indicates that the industry is aware of the hazards existing, and is at present exercising great care in the operation of its facilities. On the other hand, a number of most serious and regrettable accidents and destructive fires have occurred, and anything which can be done to disseminate knowledge of value in preventing loss of life or property due to fires or explosions should be encouraged by the industry as a whole; and, further, the taking of such steps by the industry would tend to forestall legislation which might be prohibitory in many cases.

We propose, therefore, that the industry codify, in the form of a manual of safety practice for fire prevention and protection, the most up-to-date knowledge covering the various phases of the industry's work. We feel that the necessity for this manual is extremely urgent. Just as the boiler code is recognized by steam engineers and legislative bodies generally as embodying the best practice in steam engineering, so we feel that the oil industry should have a code embodying the best practices for oil engineering. Such a code would require numerous revisions, additions, etc., from time to time; but we strongly urge that the attempt be made, backed by the American Petroleum Institute, to assemble in manual form methods and materials of the oil industry which can be regarded as representing their latest and best practices from a fire prevention and protection standpoint.

A united effort such as advocated, made in the interest of safety to life and property, would be reflected in unlooked for economies of installation and operation that would well repay the necessary effort and that would result in untold benefit to the whole industry.

CANADIAN FIELDS

(Continued from Page 70)

shutoff. This test is nearly 1,000 feet in the Devonian limestone, and is the first test in the Border Field to penetrate the Devonian. Small oil and gas shows have been reported.

In the Lethbridge area, Texas-Imperial's No. 1, LSD 14, Section 22-8-22w4, has cellar dug and is reported rigging up, test to spud in about November 15.

Red Coulee Field

On the Alberta end of the Red Coulee Field, drilling operations are practically at a standstill, except in the northwestern extension. Alberta Pacific Consolidated's No. 1, LSD 2, Section 4-1-16w4, which at one time looked like a small pumper at 2,460 feet failed to hold up and after being off production for some weeks is being abandoned and plugged.

Geologist on Red Coulee

In a recent address to the Calgary branch of the Canadian Engineering Institute, Dr. T. B. Williams of Calgary, consulting geologists for Alberta Pacific Consolidated Oils, Ltd., and discoverer of the Red Coulee Field, discussed prospects in that area. While he did not predict any spectacular wells, he believed the field would become of increasing importance with the peak of production reached in 1932. In the 13 months since completion of Vanalta's No. 1 discovery well, 18 producers have been completed and 8 dusters, and 13 wells are either drilling or temporarily shut down in horizons above the producing sands. The present potential production Doctor Williams estimated at 800 bbls., with 300 bbls. on the Canadian side and 500 bbls. on the Montana side; the companies receiving around $1.60 a bbl. The crude yields 27 per cent gasoline and 2½ per cent kerosene. In 12 months Vanalta's No. 1, in spite of delay in getting on the pump and in deepening, has produced around 15,500 bbls., and is now making 55 bbls. a day from a sand at 2,478 feet.

Doctor Williams described the Red Coulee Field as a type of anticline of which not a great deal could be expected in the way of spectacular production, as the closure was not great. The Vanalta well log shows that the bit passed through 140 feet of sand and gravel, 100 feet of Milk River sandstone and 1,700 feet of Colorado shales before obtaining production just above the Madison. The oil flow was encountered below a gas flow of 3,000,000 feet.

Ribstone Field

In the Ribstone Field, Meridian Oils' No. 3, LSD 4, Section 16-45-1w4, has not yet been given a test of the production encountered at 1,882 feet, but it is reported production may run 300 bbls., making it the best yet drilled. Ribstone Oils, Ltd., which under the direction of Ray L. Cook handled the drilling for Meridian Oils, is planning to keep two rigs through the winter, and Meridian's No. 4 will be started this fall. Members of the Cardium Syndicate of Calgary have decided to organize a company to handle the development of acreage on the structure and No. 1 test has been located in LSD 16, Section 16-45-1w4. The acreage is being secured from Ribstone Oils, Ltd., and location was made on recommendation of Geologist F. J. S. Sur. The four potential producers are shut in pending the securing of a satisfactory market for the heavy crude, small quantities of which have been taken out for testing by the Canadian National Railways for fuel oil purposes.

Fort Norman Field

Renewal of drilling in the Far North by the Atlas Exploration Co. and allied interests directs attention to the pioneer attempt by Imperial Oil, Ltd., some 10 years ago to develop the northern oil areas. According to a report prepared under direction of Charles Stewart, former minister of the interior: "Geologists and oil experts feel that oil in commercial quantities and of a high grade will be found when, under the combined urge of better transportation facilities and the development of markets for the oil and its product, more detailed and extensive search for productive horizons is instituted."

British Columbia Operations

In the Fraser Valley, British Columbia, International Pipe Line Co.'s No. 2 on Lulu Island near Steveston is reported to have encountered at 600 feet a fair flow of gas, estimated 500,000 feet. The test is having some trouble with quicksand.

On the Tobacco Plains near Dorr, in southeastern British Columbia, Pacific Petrol Products' No. 1 is reported drilling. The Dorr test started with 21½-inch hole in glacial drift; about 80 feet of drift is expected, and commercial production is thought possible at 2,500 feet. The location is inside the town of Dorr and on the south slope of a fold with about 40 per cent dip. Drilling operations are in charge of Red Willey and R. I. McCutcheon. R. H. McCutcheon, who drilled in the Pincher Creek area more than 20 years ago and later in Montana and other states, has general charge of operations. Officers of the company are: President, Arthur J. Daniels, Esquimalt, British Columbia; vice president, Horace W. Baker, Victoria; managing director, Anthony Anderson; directors, O. A. Homer, R. S. Robinson, A. W. Stewart, Fred S. Barrett, Victoria, A. J. Fouracre, Nanaimo.

Saskatchewan Drilling

In Saskatchewan, Simpson Oil Co.'s No. 1, Section 9-29-25w2, is reported to have got the lime and is now drilling in that formation considerably below 2,200 feet.

At Biggar, Saskatchewan, a town lot test is being started by Biggar Oil & Gas Co. Contract for No. 1 has been let to the Canadian Layne Co. which has 84-foot derrick up and is installing machinery. The Biggar company's holdings cover 1,600 acres east, north and west of Biggar and including a portion of the townsite.

Manitoba Structure Tests

In Manitoba, Commonwealth Petroleums, Ltd., of Calgary, has started a series of structure tests near Manitou, in the southern part of the province.

Nova Scotia Test

In the province of Nova Scotia, Imperial Oil, Ltd., is drilling an important wildcat test in Colchester County about 30 miles north of Truro and 6 miles west of Scotsburn. Location was made following extensive structure testing. Drilling was started in September and according to the latest report the well had reached a depth of 910 feet, with no showings of importance.

Drilling in Quebec

In the province of Quebec, a considerable development is apparently in prospect. Dr. W. A. Parks has conducted a careful survey of the structural geology of the lowlands of the St. Lawrence between Quebec and Montreal with especial attention to oil and gas possibilities. Large tracts have been staked for gas and oil. Some 200,000 acres have been blanketed in the past 12 months, both north and south of the St. Lawrence. The acreage lies in the counties of Portneuf, St. Maurice, Berthier, L'Assomption, Laval, Nicolet, Yamaska, Richelieu and Vercheres. Drilling was commenced this season near Lanoraie, where three shallow wells have been completed, some gas being reported. Another test has recently been started at Lachevrotiere.

Ontario Fields

In the old Ontario shallow fields, the recent reduction in crude oil prices to $1.50 for Petrolia and $1.57 for Oil Springs crude is expected to seriously curtail production. Representations were recently made to the new Federal Government in favor of the restoration of the former government petroleum bounty of 52½ cents per barrel. No action on this request can be taken until after the Federal parliament reassembles in February; but it is generally expected the bounty will be restored. This aid, however, will little more than offset the recent reduction in the price of crude, amounting to 45 cents per barrel.

Edward E. Taylor, formerly interested in Albera oil operations, is investigating reported possibilities of crude oil in Westworth County near Hamilton, and in Wellington County near Guelph and Rockton.

In Mosa Township, Middlesex County, Southern Ontario Gas Co.'s No. 4 test for gas in the Clinton sands is reported drilling.

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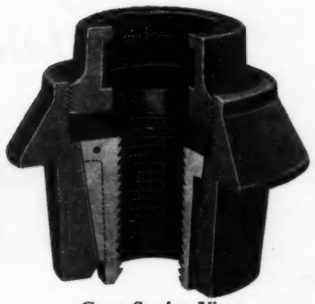

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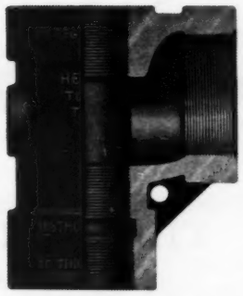

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DETERMINATION OF EVAPORATION LOSSES

(Continued from Page 78)

sample in question is thus found in the vapor pressure determination itself.

Determinations by Vapor Pressure Method

The method and apparatus developed at Whiting for determining the vapor pressures of gasoline have already been described. Measured amounts of dry air are bubbled through a gasoline sample at standard temperature in such a manner as to ensure practical saturation; the resulting vapor volume is determined, and the decrease in liquid volume is also determined. Simple calculations then permit computation of the vapor pressure of the sample. Successive determinations

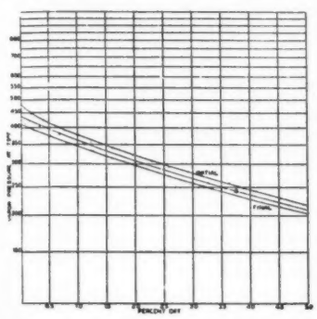

Figure 3—Displacement test—coating roof.

are made on the same gasoline until about 5 per cent has been evaporated, and the data are represented on a semi-log plot of vapor pressure vs. percentage evaporated. Several such plots appear in later figures.

Any evaporation loss which has been incurred by a gasoline will be reflected in a lowered vapor pressure curve on the depleted gasoline. If the vapor pressure curves for the original and the final gasoline are plotted on the same scale, the horizontal displacement between the two is a direct measure of the loss.[1] Since the two curves are not usually quite parallel, the loss is taken as the average of the horizontal displacement at several points. Initial vapor pressures are disregarded, since erratic results sometimes appear within the first 0.5 per cent off, due possibly to differences in dissolved air.

The accuracy of this method has been checked by tests both in the field and in the laboratory. Four field storage tanks (117'x40') were gauged before and after a period of evaporation and samples for vapor pressure measurements taken at the same time by a method described later. Table 1 gives the results.

TABLE 1—COMPARISON WITH FIELD GAUGES

	Loss	
	By gauging (%)	From computed vapor pressures (%)
First tank	0.22	0.25
Second tank	0.33	0.32
Third tank	0.26	0.37
Fourth tank	0.12	0.12

In the laboratory tests varying percentages were evaporated from a series of flasks filled with a standard 60 A.P.I. gasoline. Weights and densities (by pycnometer) were obtained before and after evaporation and the volume percentage loss computed from these data. Vapor pressures were obtained on the original and on each of the final gasolines. The result, given in Table 2, indicate good accord between the two methods. The small effect of correcting the vapor pressure curves by Wiggins' method over this range of losses is evident from a comparison of the third and fourth columns.

TABLE 2—COMPARISON WITH WEIGHED LOSSES

	Loss		
	Computed from weight	Computed from vapor pressure	
Sample No.	and density (%)	Uncorrected (%)	Corrected (%)
1	0.52	0.51	0.52
2	1.30	1.28	1.31
3	2.49	2.32	2.36
4	2.93	2.87	2.91
5	3.44	3.45	3.48
6	4.16	4.08	4.11

Storage Tests

The vapor pressure method has been applied to the detection of losses in storage tanks at Whiting during the past eight months with the object of testing its accuracy and practicability and of checking on the losses incurred in specific tank installations.

Preliminary to these tests a definite sampling procedure was established. Since the average tank can be sampled only through the thief hatch, samples were taken through this hatch and at various depths. The procedure in collecting samples was to lower a stoppered bottle to the desired depth, pull the rock, bring the bottle up, empty, and restopper quickly, and then fill a second time for the actual sample. The bottle was immediately stoppered with an oversize cork, shellacked over the top, and stored in an ice box. Duplicate samples were taken at the same time, and this procedure has been followed throughout.

The vapor pressures obtained on these samples are given in Table 3.

TABLE 3—EFFECT OF DEPTH OF SAMPLE BELOW SURFACE

Per cent evaporated	Vapor pressure, mm. mercury at 75° F.				
	2 in.	10 ft.	20 ft.	30 ft.	39 ft.
0.1	416	429	440	440	445
0.5	395	406	405	405	405
1.0	372	381	380	380	379
1.5	350	359	357	355	356
2.0	330	333	335	332	334
2.5	310	312	312	311	315

It will be observed that the 2-inch sample is distinctly lower in vapor pressure than the others, due presumably to surface evaporation. Further, the initial vapor pressure, as indicated by only 0.1 per cent evaporated, exhibits a definite though slight increase with increasing depth. With these two exceptions, the agreement is quite satisfactory, especially since initial vapor pressures are disregarded in the method of estimating losses. On the basis of this and a similar test, the midpoint of the depth, e.g., the 20-foot level in this case, was selected as standard for sampling.

Typical Results

Typical results of the storage loss tests are shown in Figures 1 and 2. Figure 1 contains vapor pressure data from five samples taken at intervals between January 13 and June 14, 1930. The upper and lower lines represent respectively the

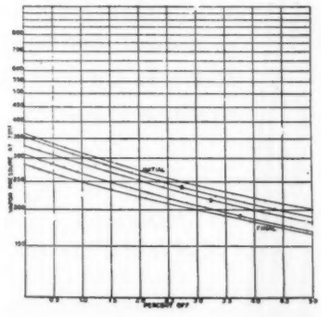

Figure 4—Displacement test—standard roof.

vapor pressure curves at the beginning and end of this period. The average horizontal displacement is 0.05 per cent, corresponding to a loss per month of only 0.01 per cent. The 0.05 per cent loss here indicated is about equal to the probable accuracy of the vapor pressure de-

[1] The assumptions here involved are that: (1) the actual gasoline lost contains the various light hydrocarbons in the same proportions as exist in the saturated vapor; (2) as a corollary, the temperature during loss is close enough to 75° F. so that the relative vapor pressures of the light hydrocarbons are the same as at 75° F.; and (3) the loss is not great enough to require correction for a change in gasoline basis such as is made by Wiggins. The validity of the first assumption is indicated by the data presented. As regards the second, the temperature during loss could be 30° F. away from the 75° F. standard without causing appreciable error. The third assumption is permissible for the small losses occurring in this work, but correction would be advisable where a loss of 3 per cent or more was involved.

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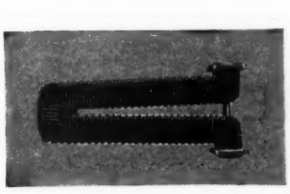

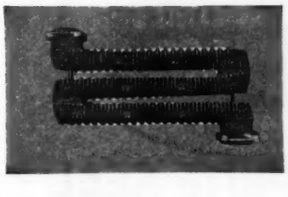

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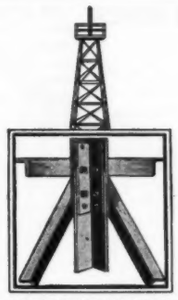

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terminations. This tank was protected by a standard breather bag, the installation consisting of three 117'x40' tanks to one 18,000 cubic foot bag. The equipment was in good condition, and the loss results are somewhat typical for the Whiting storage tanks, practically all of which are similarly protected. The average of 12 such tanks shows a loss of 0.03 per cent per month.

Figure 2 gives results on a tank where the protection was unsatisfactory due to air leakage at the eaves. Five samples were taken between December 30, 1929, and April 23, 1930, but only three are shown: the first, last, and the March 14 samples. The total loss over this period is 0.9 per cent from the average displacement of the two curves, equivalent to 0.24 per cent per month. The intermediate data indicate that the rate of evaporation was less than this up to March 14 and greater for the last period, as might be expected from weather con-

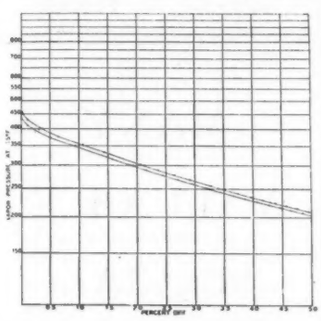

Figure 5—Effect of method of sampling.

ditions. Several other large tanks, with no protection or with leaks in the system, showed losses from 0.2 to 0.3 per cent per month over a corresponding period.

Gauged Losses

It is interesting to compare these results with the gauged losses reported in an earlier paper from this laboratory. The average losses at that time were estimated at 0.25 per cent per month for unprotected tanks and 0.04 per cent for tanks with breather bags, checking closely with the present determinations. It is true that these estimates were applied over only a seven-month period from March 1 to September 30, whereas current data include winter conditions. The difference in weather, however, is largely neutralized by the fact that gasoline manufactured and stored in winter has a higher volatility than summer gasoline. These data, therefore, not only confirm the high efficiency of breather bag equipment as a means of conservation, but emphasize the need for protective measures on gasoline even during the cold weather months.

Displacement Losses

The chief utility of the vapor pressure method is not, however, in measuring storage losses, where gauging can be employed, but in studying evaporation losses due to movement of stocks. For such purposes the gasoline may be sampled at various stages in its movement, and the vapor pressure measurements will give the percentage evaporated at any time. Accurate gauging is quite impracticable for work of this type except in a few special cases. Of course, leakage and spillage losses cannot be detected by this method.

Recent tests at Whiting on stock movement in large standard and floating-roof tanks well illustrate the application of vapor pressures to this problem. The test procedure consisted in moving a layer of gasoline up and down in the tank by means of water beneath the gasoline, repeating or varying the cycle as desired, and determining the vapor pressure of the tank contents at stated intervals. By using only a few feet of gasoline in a 60'x40' tank, the loss was magnified in percentage, permitting greater accuracy in estimating losses from vapor pressure data. Only one tank and a small amount of gasoline were required for a test, and no complications of line or pump losses were introduced.

The data and results of these tests are given in Figures 3 and 4 and in Table 4.

TABLE 4

Displacement Tests

Inspection on initial gasoline—	Floating roof tank	Standard roof tank
Gravity, ° A.P.I.	59.4° F.	60.7° F.
Initial	88° F.	100° F.
10 per cent	153° F.	152° F.
30 per cent	225° F.	208° F.
50 per cent	272° F.	249° F.
90 per cent	362° F.	340° F.
Maximum	394° F.	388° F.
Loss	3.0%	2.0%
Test period	Apr. 8-28, 1930	July 9-18, 1930
Temperature of gasoline	50° F.	72° F.

Floating Roof Tank

No. of cycles	Volume displaced (gallons)	Gasoline in tank (gallons)	Per cent loss on gasoline in tank	Per cent loss on volume pumped
		74,050		
8	5,140,000		0.30	0.0043
		73,830		
10	5,150,000		0.28	0.0038
		73,630		
18	10,590,000		0.57 on original	
Average				0.0040%

Standard Roof Tank

No. of cycles	Volume displaced (gallons)	Gasoline in tank (gallons)	Per cent loss on gasoline in tank	Per cent loss on volume pumped
		106,000		
2	1,330,000		0.40	0.032
		105,580		
2	1,310,000		0.38	0.031
		105,180		
2	1,310,000		0.59	0.047
		104,560		
2	1,350,000		0.53	0.041
		104,010		
8	5,300,000		1.88 on original	
Average				0.038%

These tests indicate a very small displacement loss from floating roof tanks, amounting to only 0.004 per cent on the stock handled. The loss with a standard roof is 10 times as great, and would presumably be somewhat greater yet but for the 22 per cent decrease in vapor pressure incurred in the operation. However, even a correction for this factor could not well bring the loss above 0.05 per cent, which is far below any computed loss assuming saturation of vapors in the tank.

It should be noted that a previous run had been made on the standard roof tank in April, simultaneously with that on the floating roof, which showed an average loss of 0.05 per cent on the volume pumped. Certain factors, such as time of filling and emptying and of standing between operations, were investigated in the July test, but the data obtained do not justify final conclusions on these points. However, larger losses would be expected with slower filling or with smaller tanks.

An approximate check on the vapor pressure method was obtained by analyses of vapors issuing from the breather pipe during tank filling. The concentration of condensables, measured by absorption in mineral seal oil, was uniformly low until the tank was nearly full. The average concentration ran about 12 per cent, corresponding to a computed displacement loss of approximately 0.05 per cent, and, therefore, checking the loss found by the other method.

Other Applications

Losses outside the refinery, from either crude or gasoline, offer a most promising field for the vapor pressure method. Determinations could be made on gasoline transported by various means, and even in automobile tanks, to determine with accuracy either the loss which has been incurred or the current volatility characteristics of the fuel.

A necessary precaution for accuracy in work on distribution losses is that the gasoline shipment be kept free from contamination or that the contaminating stock be sampled and corrections made for its effect. In the latter instance, thorough mixing of stocks is imperative before a sample of the mixture is taken.

The method of sampling is of vital import, as indicated in Figure 5. The lower curve is for a gasoline from a service station pump with the nozzle held at the mouth of a 2-gallon sampling can. The upper curve is for a sample taken immediately thereafter, by inserting the nozzle into the can and also allowing several quarts of gasoline to overflow before closing the can. The difference between these two curves represents a difference of 0.2

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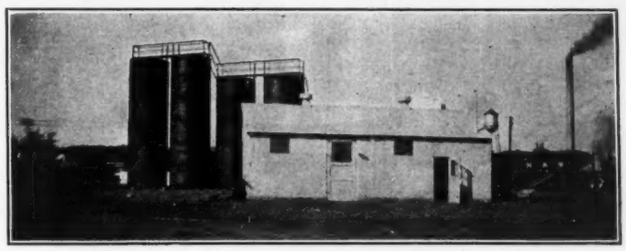

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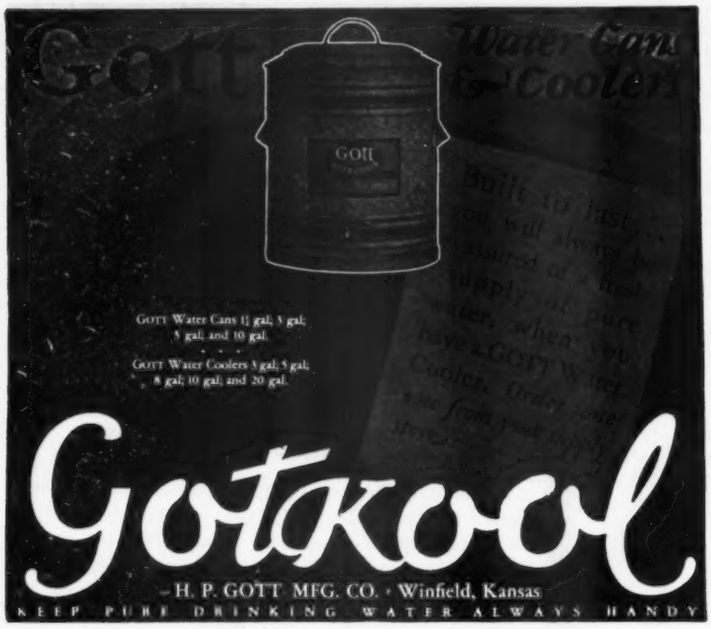
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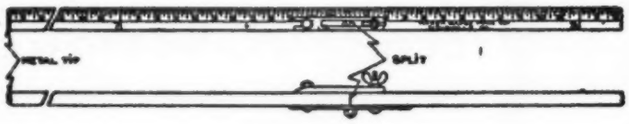

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per cent in the losses incurred by the two filling procedures. Samples should, of course, be sealed at once and transferred to an ice box. Any later transfers of samples in the laboratory are carried out by water displacement with the gasoline precooled, and the first and last portions so transferred are discarded.

Probable Accuracy

Experience with the method shows that vapor pressures can be determined with a probable accuracy of about 0.75 per cent in the range above 0.5 per cent evaporated. On average gasoline this justifies estimations of losses as low as 0.04 per cent. Whether the over-all accuracy of the loss determination is as good as this depends upon care in taking and handling samples, but results in this laboratory show that it can be achieved with fair regularity.

Conclusions

The vapor pressure method offers a simple means for determining a property of gasoline which is sensitive to slight losses by evaporation. The method permits direct comparison between two samples without further experimental data and can, therefore, be applied on any type of gasoline. This is a decided advantage over other published vapor pressure methods, which would require an independent investigation of the relation between vapor pressure and loss for the oil in question.

Since its operation requires only the collection of samples and subsequent laboratory determinations, it can be employed in many conservation problems, where accurate gauging or vapor analyses are impracticable, if not impossible. Its field of particular usefulness may be expected to be the investigation of losses in the transfer of stocks outside as well as within the refinery.

Theoretical considerations of its inherent accuracy are confirmed by the data here presented on field and laboratory tests. Its applicability and convenience for studying storage losses, as well as the accuracy attained, are evident from the results on protected and unprotected tankage, where it takes the place of gaugings. Its application to displacement losses on standards and floating-roof tanks is typical of the possibilities in following evaporation on stocks in movement.

The storage tests here reported are also interesting as a confirmation of the results on unprotected tanks previously reported by this laboratory, and as an indication of the high efficiency of breather bags for protecting standing storage. The displacement tests in turn demonstrate the effectiveness of floating roofs on working tankage, but at the same time show that evaporation losses due to rapid filling of standard roof tanks in good conditions are not as high as had been generally assumed. Total losses attending displacement of gasoline should, however, be much higher on the average.

The present accuracy of about 0.04 per cent is adequate for the detection of small losses, and is greater than would be required in many cases. Considering this accuracy and the wide field of applicability, it appears that the vapor pressure method may be the most generally satisfactory means at present available for studying evaporation losses.

Acknowledgment

The assistance of J. C. Stauffer, M. B. Palmer and J. E. Moore in obtaining the experimental results herein reported is gratefully acknowledged.

DRILLING IN GERMANY

Oil prospecting will soon commence in the villages adjoining Itzehow, Schleswig-Holstein, not far from Hamburg, Germany, according to German information contained in a report from Consul E. Talbot Smith, Hamburg. Drilling is to be started at once.

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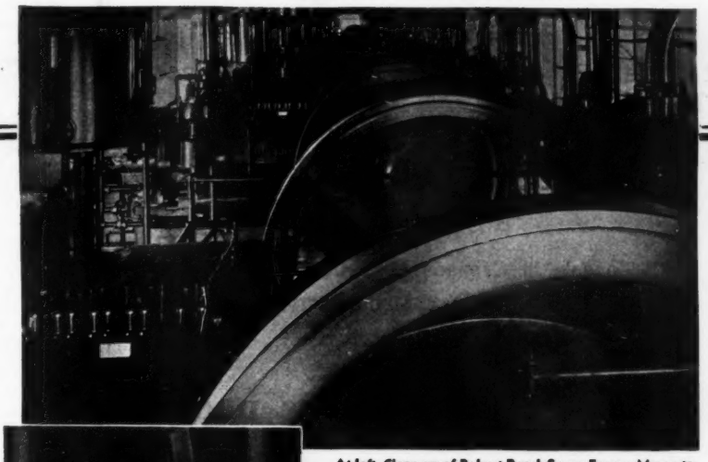

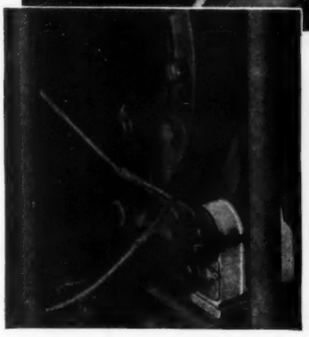

At left: Close-up of Robert Bosch Super-Energy Magneto installation in Gypsy Oil Co. plant shown above.

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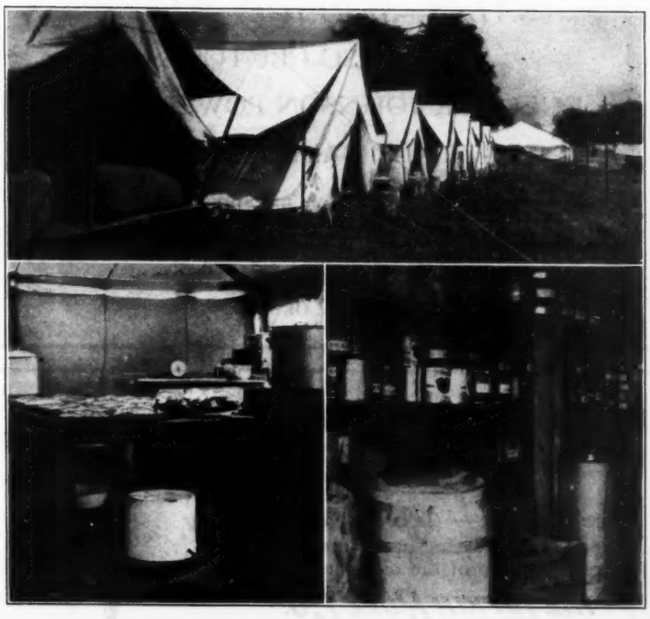

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CENTRAL WEST FIELDS

(Continued from Page 90)

feet. C. C. Taliaferro, Jr., got an average sized gas well in No. 4 well, 1,600 feet from the north line and 750 feet from the west line of the Aaron George farm, SW Section 30, Washington Township, same county. Top of sand was 1,109 feet and total depth 1,130 feet. T. N. Sanage and others are drilling No. 3 Byron Preston farm, same section. In Patoka Township, same county, V. E. Bolyard and others' test in the southeast corner of the Everet Crow farm, NE Section 25, is reported with a gas volume of 1,000,000 feet, at 8 feet in the sand at a total depth of 1,123 feet.

Fred F. Bays drilled a dry hole 1,320 feet from the north line and 1,600 feet from the west line of the W. C. Jamison farm, SE Section 32, Turman Township, Sullivan County, at a depth of 800 feet.

Milligan & Brown are drilling on the Smith's Stone Quarry, in Wayne Township, Jay County. In Jackson Township, same county, J. J. Adams abandoned Nos. 2, 3, 4, 5, 6 and 7 S. W. Reed farm, and Nos. 11 and 12 P. Hamilton farm, in Section 12. In Knox Township, Citizens Bank of Portland abandoned Nos. 1, 2, 3, 4, 5, 6 and 7 Charles Dale farm, Section 4. In Bear Creek Township, same county, Spence & Pontius abandoned No. 4 T. W. Shrimp farm, and No. 2 William F. Metzger farm, both in Section 28.

Berninda Oil & Gas Co. abandoned No. 4 D. Studebaker farm, Section 5, Jefferson Township, Adams County. Bert Dennison is drilling on the Charles Wiley farm, Section 13, same township.

A. B. Bement is drilling No. 3 Phoebe McAtee, Location 13, Clay Township, Pike County.

ILLINOIS

In Dennison Township, Lawrence County, Charles Karns and others' No. 2 well, in the southwest corner of the C. C. Ackman farm, SW Section 1, is at 440 feet. The Ohio Oil Co. abandoned old No. 1 on the William T. Buchanan farm, Section 6, same township.

In the Allendale Field, of Wabash Township, Wabash County, the Highland Oil & Gas Co.'s No. 5 in the southwest corner of the J. M. Mullinax farm, NE NE, Section 5, pumped 30 bbls. initial from 1,544-64 feet. Edrite Oil Co.'s No. 4 well, 800 feet from the north and east lines of the Ed Wright farm, NE Section 13, same township, was dry at 1,605 feet. In the same township, J. D. Toomey and others are drilling No. 13 Harrison Buchanan farm, Section 10. Robinson Oil Co. is drilling No. 3 William Schaeffer farm, and No. 2 Adama Schaeffer, both in Section 15, and Highland Oil & Gas Co. is starting No. 2 M. Loeffler farm, Section 5.

In Dennison Township, Lawrence County, the Ohio Oil Co. abandoned No. 4 J. W. Perry farm, SW Section 6. John Phipps and others are drilling No. 10 J. W. Clark No. 2 farm, Section 2, same township.

In the Dupo Pool, Sugar Loaf Township, St. Clair County, Joseph May and others are drilling No. 1 Charles Hoffman, Section 27, and William J. Abbott abandoned No. 1 A. Osick, Lot 16, same township.

Dain Oil Co. abandoned No. 1 Holson-Dorney farm, NW Section 18, Wabash Township, Wabash County. Ohio Oil Co. abandoned No. 1 J. B. Wilkins farm, SW Section 11, Wade Township, Clinton County.

Alspach and others are drilling on the Demint-Hardy land, in Survey 743, Rebault Township, Monroe County.

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Meramas Oil Co. is drilling No. 1 in the city of Valley Park, in St. Louis County, Missouri.

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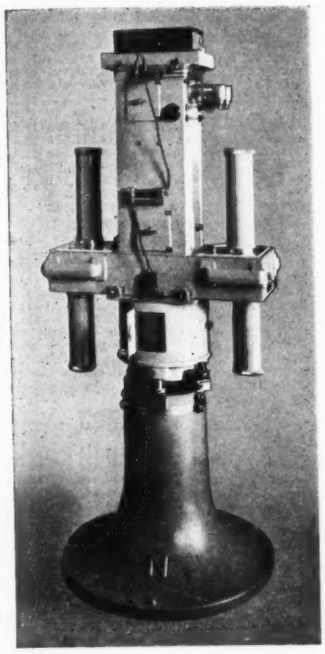

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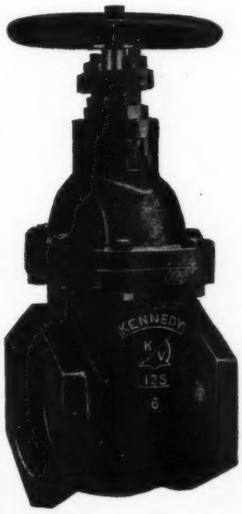

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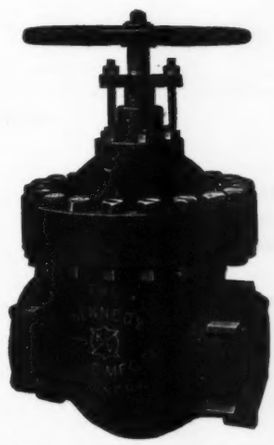

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OKLAHOMA-KANSAS

Pipe Line Report for Month of August, 1930

Runs

	Month (bbls.)	Dy.ave. (bbls.)
Prairie P. L. Co.*	3,103,000	100,100
Gulf P. L. Co.	1,373,377	44,302
Texas P. L. Co.	647,390	20,850
Magnolia P. L. Co.	1,376,804	44,413
Empire P. L. Co.	1,821,333	58,753
Cosden P. L. Co.	752,407	24,271
Sinclair P. L. Co.*	3,044,206	98,200
Oklahoma P. L. Co.	3,184,696	102,732
Other lines*	5,456,000	176,000
Total August	20,759,207	669,651
Total July	21,571,630	695,858
Difference	812,423	26,207

Shipments

Prairie P. L. Co.†	5,324,835	171,769
Gulf P. L. Co.	1,338,477	43,177
Texas P. L. Co.	1,406,320	45,365
Magnolia P. L. Co.	1,973,649	63,666
Empire P. L. Co.	2,164,408	69,820
Cosden P. L. Co.	727,772	23,477
Sinclair P. L. Co.†	3,244,253	104,653
Oklahoma P. L. Co.	3,092,998	99,774
Other lines*	4,567,000	147,000
Total August	23,839,712	768,701
Total July	23,592,103	761,035
Difference	237,609	7,666

Stocks

Prairie O. & G. Co.*	37,015,000
Gulf P. L.-Gypsy Oil Co.	3,085,136
The Texas Company	4,245,408
Magnolia Petroleum Co.	5,954,406
Empire P. L. Co.	5,296,159
Mid-Continent Pet. Corp.	3,784,079
Sinclair Crude Oil Pur Co.*	20,414,000
Oklahoma P. L. Co.	3,160,977
Carter Oil Co.	9,564,846
Other lines*	24,754,000
Total August	122,274,011
Total July	123,633,063
Difference	1,359,052

*Estimated. †Prairie and Sinclair shipments include Texas crude oil.

EASTERN PIPE LINE REPORT FOR MONTH OF SEPTEMBER

Runs From Wells

In the following table will be found the regular receipts from wells by various pipe lines in New York, Pennsylvania, West Virginia, Ohio, Kentucky, Illinois, Indiana and Michigan for August and September:

	Aug.'30	Sept.'30
Nat. Transit	118,378.49	126,408.01
S. W. Pa. P. L.	70,719.58	76,584.80
Eureka P. L.	272,439.56	286,627.14
Buckeye P. L. (Macksb'g)	320,091.51	335,374.02
Buckeye P. L. (Cleve)	11,270.77	11,061.63
Buckeye P. L. (Lima, etc.)	91,699.80	93,802.50
Indiana P. L.	3,933.81	5,054.52
Cum'land P. L.	169,133.16	179,527.92
N. Y. Transit	26,399.13	39,583.19
Tidewater P. L.	26,087.89	25,675.10
Pure Oil	255,892.02	191,912.84
Stoll Oil Rfg	3,500.15	3,317.59
Bradford Tran.	314,490.88	322,922.66
Total	1,683,036.75	1,697,851.92
Daily avg.	54,291.51	56,595.07

Note—Indian Refining Co. had other receipts of 299,733.91 bbls.

Eastern Gulf Oil reported runs of 8,872.74 bbls.

Petroleum Deliveries

The following tables exhibit the shipments or regular deliveries of various pipe lines in New York, Pennsylvania, West Virginia, Ohio, Kentucky and Indiana for August and September:

	Aug.'30	Sept.'30
Nat. Transit	479,192.75	484,508.49
S. W. Pa. P. L.	280,390.24	256,281.87
Eureka P. L.	273,684.53	244,918.35
Buckeye P. L. (Macksb'g)	160,065.90	216,745.14
Buckeye P. L. (Cleve.)	1,713.66	1,712.02
Buckeye P. L. (Lima, etc.)	1,394,277.59	1,075,693.52
Indiana P. L.	1,335,998.08	1,128,187.83
Cum'land P. L.	205,045.71	136,895.24
Southern P. L.	69,211.54	66,892.64
N. Y. Transit	172,930.08	154,725.36
Northern P. L.	172,321.25	124,793.90
Tidewater P. L.	504,721.54	585,647.29
Pure Oil	197,492.59	183,063.59
Indian Ref.	375,829.22	373,510.39
Bradf'd Trans	381,474.90	425,829.96
Tuscarora Oil	503,354.86	360,569.02
Total	6,370,704.44	5,819,974.55
Daily avg.	205,506.59	193,999.15

Gross Stocks

The gross stocks held by various pipe lines in the oil producing sections of New York, Pennsylvania, West Virginia, Ohio, Indiana and Kentucky and Indiana at the close of August and September:

	Aug.'30	Sept.'30
Nat. Transit	808,225.58	765,612.70
S. W. Pa. P. L.	490,266.60	542,827.03
Eureka P. L.	1,603,479.10	1,516,135.69
Buckeye P. L. (Macksb'g)	694,516.87	665,285.49
Buckeye P. L. (Cleve.)	66,315.01	66,500.27
Buckeye P. L. (Lima, etc.)	5,004,621.10	5,065,078.07
Indiana P. L.	836,606.05	759,036.08
Cum'ld P. L.	547,844.28	548,890.67
South'n P. L.	245,676.27	294,744.69
N. Y. Transit	144,696.68	139,813.32
North'n P. L.	416,121.94	480,715.71
Tidew'r P. L.	1,043,300.56	967,099.18
Pure Oil	507,198.43	520,059.95
Indian Ref.	161,817.52	88,060.52
Tuscarora	278,425.17	276,805.35
Brad Trans	197,440.63	125,354.37
Total	13,047,051.84	12,812,018.99
Decrease	221,511.00	235,032.85

Grades of Oil

The following table shows the amount of the different grades of oil held by the Eastern Pipe Lines at the close of August and September showing gross stocks of the above fields:

	Aug.'30	Sept.'30
Penna.	4,044,608.48	3,921,022.36
Lima	815,257.62	828,284.49
Kentucky	594,501.57	596,275.33
Mid-Cont.	7,051,195.35	6,946,872.38
Illinois	44,760.06	10,632.05
Michigan	496,728.56	508,932.40
Total	13,047,051.84	12,812,018.99

Daily Average Runs

The following table shows the daily average runs of the Pennsylvania, Lima and Kentucky oil fields for the past four years:

	1927	1928	1929	1930
Jan.	56,209	52,904	51,749	75,907
Feb.	61,298	57,002	51,833	79,256
Mar.	63,247	57,485	54,252	76,688
April	60,927	56,812	53,444	84,536
May	60,284	62,067	59,902	80,548
June	62,757	58,230	58,833	75,430
July	58,674	57,144	66,087	68,921
Aug.	60,870	57,745	66,087	54,291
Sept.	60,285	53,487	67,315	56,596
Oct.	147,080	58,100	76,093	.....
Nov.	57,275	53,365	74,831	.....
Dec.	53,089	52,025	74,561	.....

Daily Average Shipments

The following table gives daily average shipments from the Pennsylvania, Lima and other fields for the past four years:

	1927	1928	1929	1930
Jan.	141,227	146,465	165,721	217,623
Feb.	138,534	167,368	159,387	224,355
Mar.	133,777	158,883	161,474	228,846
April	140,227	172,935	169,737	241,845
May	144,594	180,559	184,281	248,383
June	149,772	188,024	185,404	234,401
July	151,850	189,470	194,763	207,094
Aug.	188,653	192,853	184,946	205,504
Sept.	144,213	194,138	201,214	193,999
Oct.	147,036	176,000	191,867	.....
Nov.	150,975	176,898	202,743	.....
Dec.	144,504	173,572	186,267	.....

Gross Stocks

In the following table will be found the gross stocks of the various lines of the Pennsylvania, Lima and Kentucky oil fields, including oil received from other lines at the close of each month for the past three years:

	1928	1929	1930
Jan.	12,276,710	7,596,564	12,220,045
Feb.	12,180,419	8,738,835	12,991,561
Mar.	12,239,725	9,002,058	13,247,217
April	11,740,125	8,978,172	13,233,961
May	11,602,468	8,903,560	13,052,953
June	11,287,678	8,921,275	13,396,854
July	10,819,331	9,211,595	13,268,562
Aug.	10,236,743	9,440,643	13,047,061
Sept.	9,660,910	9,443,067	12,812,018
Oct.	9,229,709	9,441,101	.....
Nov.	8,366,553	9,868,538	.....
Dec.	7,539,555	11,253,953	.....

The Illinois Field

The following table gives the report of the Illinois Pipe Line Co. in Illinois:

Gross stocks, Sept. 30	1,879,669.20
Runs from wells	431,326.01
Other receipts	147,343.64
Regular deliveries	346,016.53
Other deliveries	222,967.58

The amount of Illinois oil run by the Tidewater Pipe Co. in September was 25,675.10 bbls. Deliveries were 25,675.10 bbls. Adding these figures to those of the Illinois Pipe Line Co. makes the runs and deliveries as follows:

	Runs	Deliveries
Sept.	457,001.11	371,691.43
1929		
Feb.	517,320.17	503,387.70
March	728,319.67	586,049.60
April	515,374.27	654,297.96
May	608,981.60	673,812.83
June	568,454.70	818,846.97
July	611,106.79	828,159.44
Aug.	625,851.99	746,425.06
Sept.	582,457.66	669,947.72
Oct.	622,302.83	558,558.60
Nov.	565,108.75	427,064.63
Dec.	548,924.41	489,368.81
1930		
Jan.	543,887.95	498,293.91
Feb.	548,416.38	414,586.59
March	631,944.49	469,119.53
April	530,074.22	509,304.40
May	605,147.37	504,069.36
June	572,662.57	468,658.81
July	604,529.54	388,454.47
August	594,642.12	375,742.43

Tidewater Pipe Co., Ltd., also delivered in September, 308,731.02 bbls. Oklahoma oil.

AVERAGE DAILY RECEIPTS OF CALIFORNIA CRUDE AND REFINED OIL AT ATLANTIC AND GULF PORTS

Average barrels per day in 1929-30—	ATLANTIC PORTS						GULF COAST PORTS					
	Baltimore	Boston	New York	Philadelphia	Others	Total	Galveston	New Orleans Baton Rouge	Port Arthur Sabine Pass	Tampa	Total	Total all ports
September	19,433	.....	31,834	11,900	6,200	69,367	.....	.....	.....	.....	4,800	74,167
October	9,065	4,677	42,045	12,000	9,677	77,484	.....	.....	.....	.....	4,097	81,581
November	18,900	8,167	41,667	14,699	3,767	82,200	.....	.....	.....	.....	2,400	84,600
December	12,968	.....	46,129	13,613	7,225	79,935	.....	.....	.....	.....	2,335	82,270
January	18,484	1,936	34,257	22,323	9,516	86,516	.....	.....	.....	.....	2,258	88,774
February	7,678	.....	24,714	14,321	5,000	51,714	.....	.....	.....	.....	2,607	54,321
March	10,548	3,065	28,871	8,774	22,484	73,742	.....	.....	.....	.....	805	74,548
April	7,767	.....	14,369	11,600	7,433	41,167	.....	.....	.....	.....	7,600	48,767
May	5,194	8,451	28,161	9,484	2,774	54,064	.....	.....	.....	.....	774	54,838
June	8,300	.....	32,933	20,767	2,333	65,333	.....	.....	.....	.....	2,400	67,733
July	17,355	7,774	43,419	23,339	6,452	98,339	.....	.....	.....	.....	4,645	103,484
August	7,418	3,742	38,968	21,226	5,258	81,613	.....	.....	.....	.....	97	81,710

AVERAGE DAILY IMPORTS OF CRUDE AND REFINED OIL AT PRINCIPAL UNITED STATES PORTS

Average barrels per day in 1929-30—	ATLANTIC PORTS						GULF COAST PORTS					
	Baltimore	Boston	New York	Philadelphia	Others	Total	Galveston	New Orleans Baton Rouge	Port Arthur Sabine Pass	Tampa	Total	Total all ports
September	32,967	9,000	136,633	54,300	32,900	265,800	6,900	22,900	5,367	1,333	36,500	302,300
October	39,936	10,519	137,096	38,160	38,644	264,355	6,613	13,388	11,064	4,419	35,484	299,839
November	22,633	18,900	125,200	41,100	28,200	237,033	2,233	12,533	6,667	2,500	23,933	260,966
December	29,774	15,387	133,742	31,000	23,775	233,678	5,548	16,484	6,613	1,774	30,419	264,097
January	31,161	10,678	134,581	38,677	43,806	248,903	4,322	6,453	.....	548	11,323	260,226
February	24,500	14,714	147,357	36,036	39,786	262,933	2,821	11,072	3,500	1,964	19,357	282,750
March	28,355	3,839	151,806	36,645	34,903	255,548	4,323	11,645	839	2,419	19,226	274,774
April	31,400	8,933	123,500	40,433	19,434	223,700	.....	7,400	2,433	4,167	14,000	237,700
May	24,129	9,322	174,194	39,291	28,226	275,161	8,194	11,548	2,935	1,323	24,000	299,161
June	51,533	15,667	121,067	45,033	25,033	258,333	4,413	17,367	2,167	1,333	25,300	283,633
July	42,097	9,548	154,968	37,935	36,032	280,580	5,678	9,161	2,097	2,387	19,323	299,903
August	39,033	4,484	145,613	33,355	25,097	247,581	3,419	9,323	8,548	3,000	29,290	276,871

GROSS PRODUCTION OF CRUDE OIL IN THE UNITED STATES FOR 12 MONTHS

(In Barrels of 42 Gallons)

1929-30—		California	Oklahoma	Texas	Kansas	Arkansas	Louisiana	Rocky Mts.	Eastern	Total
September:	Month	26,104,264	21,299,490	26,067,065	3,780,690	1,959,720	1,718,250	2,347,020	4,075,000	87,351,499
	Daily average	870,142	709,983	868,902	126,023	65,324	57,275	78,234	135,917	2,911,716
October:	Month	26,895,160	20,821,646	26,412,167	3,429,468	2,000,027	1,956,326	2,392,952	4,482,000	88,389,746
	Daily average	867,586	671,666	852,004	110,628	64,517	63,107	77,192	141,358	2,851,331
November:	Month	21,317,540	19,193,760	24,896,034	3,430,560	1,911,060	1,853,565	2,350,110	4,029,000	78,981,629
	Daily average	710,585	639,798	829,868	114,352	63,702	61,785	78,337	134,300	2,632,730
December:	Month	21,705,554	20,092,876	25,609,823	3,549,066	1,917,071	1,878,352	2,378,754	4,168,100	81,299,596
	Daily average	700,179	648,156	818,394	114,486	61,841	60,592	76,734	134,455	2,622,568
January:	Month	21,983,242	20,802,984	25,284,352	3,273,197	1,817,685	1,780,969	2,151,090	4,216,000	81,309,519
	Daily average	709,137	671,064	815,624	105,587	58,635	57,451	69,390	136,000	2,622,588
February:	Month	20,885,660	17,977,624	23,314,637	2,965,704	1,608,376	1,738,425	2,027,984	3,780,000	74,298,410
	Daily average	745,916	642,058	832,665	105,918	57,442	62,087	72,429	135,000	2,653,517
March:	Month	19,699,979	19,112,306	25,503,880	3,504,395	1,817,871	1,943,093	2,337,028	4,231,500	78,149,353
	Daily average	635,483	616,526	822,679	113,045	58,641	62,680	75,388	136,500	2,520,943
April:	Month	18,768,743	19,541,310	24,799,768	3,734,253	1,724,460	1,909,552	2,334,810	4,134,000	76,946,896
	Daily average	625,625	651,377	826,658	124,475	57,482	63,652	77,827	137,800	2,564,837
May:	Month	19,044,444	20,587,503	26,214,068	3,978,385	1,659,895	1,914,290	2,565,219	4,402,000	80,365,804
	Daily average	614,337	664,113	845,615	128,335	53,545	61,751	82,749	142,000	2,592,440
June:	Month	18,020,795	19,754,900	25,643,705	3,765,060	1,704,060	1,923,621	2,519,190	3,880,000	77,211,331
	Daily average	600,693	658,490	854,791	125,502	56,802	64,187	83,973	129,300	2,573,711
July:	Month	18,802,024	18,032,514	25,910,929	3,541,409	1,713,680	2,079,763	3,275,894	3,844,000	77,200,213
	Daily average	606,517	581,694	835,835	114,239	55,280	67,089	105,674	124,000	2,490,353
August:	Month	18,770,466	17,255,034	25,538,513	3,491,530	1,700,102	2,151,130	3,193,341	3,417,000	75,517,146
	Daily average	605,499	556,614	823,823	112,630	54,842	69,391	103,011	110,226	2,436,036
Total 12 months		251,997,871	234,471,947	305,194,440	42,443,717	21,534,067	22,847,332	29,873,393	48,658,600	957,021,367